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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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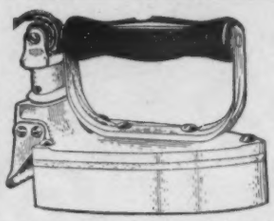

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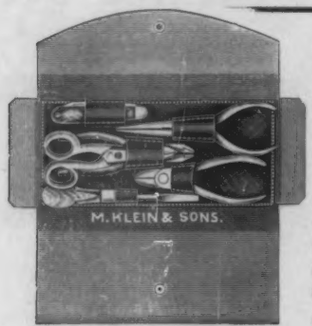

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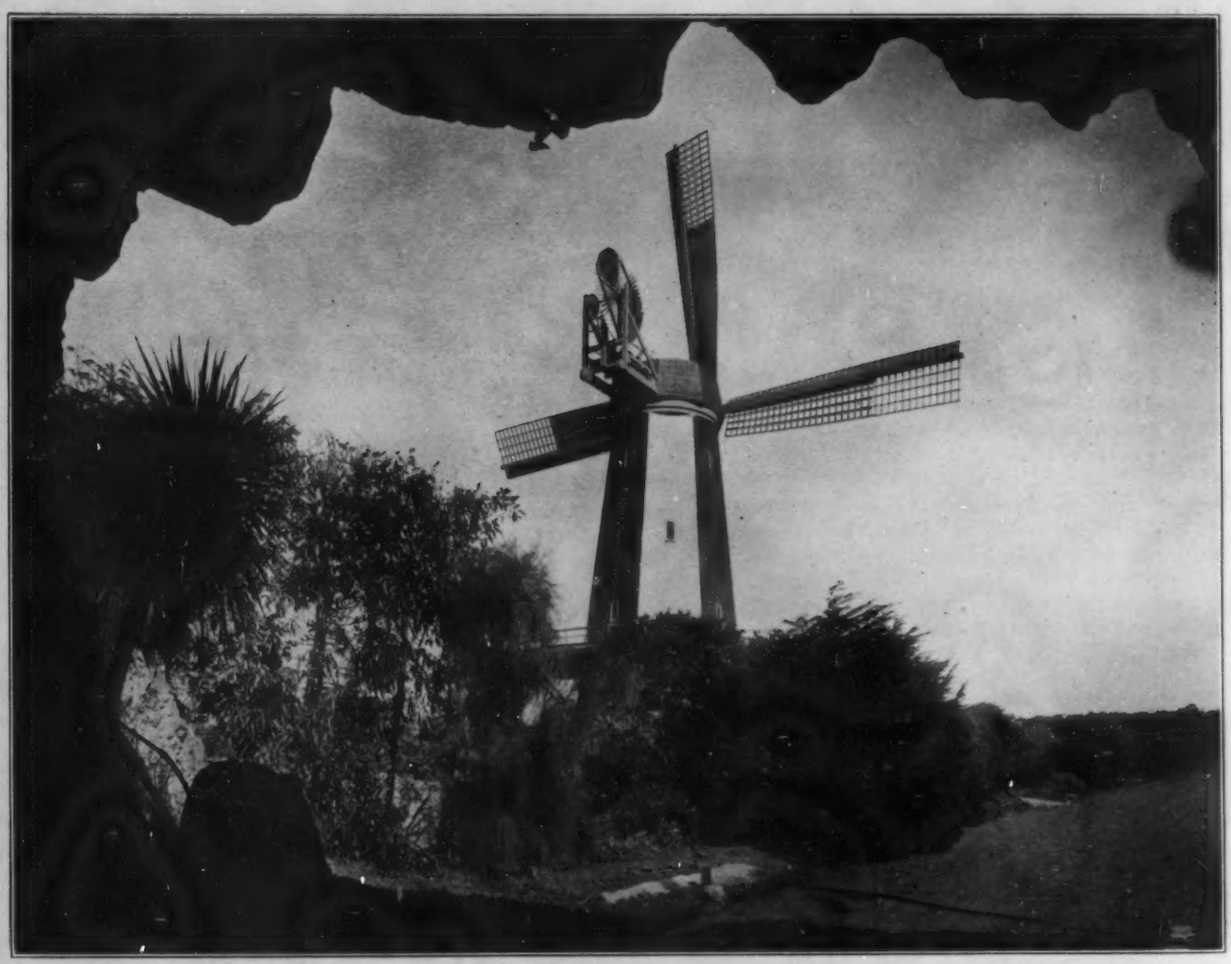
VOLUME XXII. SAN FRANCISCO, FEBRUARY 20, 1909 NUMBER 8

THE LARGEST WINDMILL IN THE UNITED STATES

Several years ago a Dutch windmill was built in Golden Gate Park, San Francisco, close to the tossing waves of the Pacific. So picturesque was its appearance and so successful its operation that its mate has been recently constructed several hundred feet to the south. These are the two largest windmills in the United States, the original having a diameter of 102 feet and the new of 114. The sweeping arms of these transplanted scions of Holland greet the mariner entering the harbor of San Francisco from the Pacific. They pump water for the various artificial lakes in which this great park abounds.

The powers of Nature are valuable in proportion to their economy and their dependability. There is probably nothing cheaper than wind, and nothing as unreliable. But in this case the trade winds from the Pacific spring up about the time the dry season begins and blow a steady gale until the fall rains set in; their gentle insistence drives this great mill and pumps much of the water required during this period of natural drougth. With their utility and dependability proven by use, they combine the rare quality of being both useful and ornamental.

The new mill is larger in every respect than its predecessor which was described in this journal in March, 1905. It stands 85 feet from the ground to the centre support of the arms, these having a further radius of 57 feet which gives a total height of 142 feet. Their tower support is essentially a truncated, octagonal pyramid, substantially built and covered with slate. The base is constructed of concrete strongly reinforced with steel



View of Dutch Windmill in Golden Gate Park, San Francisco, From Within Tunnel Under Roadway.

rails. The basal diameter is 60 feet gradually diminishing to 24 feet at the turret top. Within this five storied tower, whose walls taper from a thickness of four feet at the base, is placed a great pump, having a capacity of 60,000 gallons hourly. Each story of the structure supports the verticle shaft which transmits the power from the windmill to the pump.

The four arms, or sails, of the mill turn a great steel shaft, twenty-two feet long and thirteen inches in diameter to which they are attached by a heavy iron hub. Each of these arms consists of a long spar of Oregon pine, upon which is mounted wind-boards and sails to give an effective wind area of 516 square feet for each arm, making a total of 2064. This maximum may be considerably reduced by furling the canvas in case of high winds. A small steering wheel with a diameter of sixteen feet keeps the power wheel always in the wind, just as the helmsman controls a ship by the rudder. The steering wheel stands at right angles to the large mill so that its blades receive no energy as long as the large mill is directly to the wind. Should the wind direction shift ever so slightly, the small wheel turns and pulls the power mill into the wind again, its motion being transmitted through four sets of gears to the revolving turret, giving a proportion of 7500 to 1. A double band brake, lever-operated, has been substituted for the half brake of similar type, which proved insufficient to hold the mill, if it was to be stopped.

Experience in Holland has shown that a maximum of power is obtained with a slight elevation of the axis above the horizontal, and consequently the main shaft has been mounted at an angle of twelve degrees thirty minutes. The power varies with the velocity of the wind and the extent of sail areas. The following table has been compiled for the various wind velocities at a maximum sail area:

Miles per hour.	Horsepower.
4	0.383
6	1.283
8	2.193
10	5.953
11	7.473
12	10.32
14	16.35
16	24.37
18	34.65
20	47.63
25	92.91
30	160.75
40	381.08

These results are theoretical. The sails are furled as the wind velocity exceeds 20 miles per hour.

The power is transmitted by gearing through the vertical shaft to the pumps. These are two vertical, single-acting, triplex, plunger pumps, built by George E. Dow Pumping Engine Company of San Francisco. The plungers have a diameter of ten inches with a twelve inch stroke. The new mill has not yet been put into practical operation but has a rated capacity of 1,000 gallons per minute.

The water is pumped through a 14-inch suction nozzle from a great sump that collects the seepage and run-off of the surrounding country. Although this sump is within one hundred feet of the beach, its water is always fresh, because the hydrostatic pressure of the ground water is greater than that of the sea water.

Government engineers have recently concluded a series of experiments on the pumping capacity of the older pump and as soon as these are available the report will be published in these columns. It is roughly estimated that the cost of the pumping is about three cents per thousand gallons.

This windmill has been furnished through the generosity of the late Mr. Samuel G. Murphy of San Francisco, a former Park Commissioner and President of the First National Bank. This mill, like its predecessor, was designed by Mr. J. C. H. Stutt and was installed under the direct supervision of Mr. J. Dikeman, Superintendent of the Golden Gate Park Water Works, and under the general supervision of Mr. John McLaren, Superintendent of Golden Gate Park. Mr. McLaren is so well pleased with the landscape effect and with the pumping performances of these two mills that he hopes to have several more built along the ocean frontage to supplement the work of the main steam pumping plant.

PRIME MOVERS.[1]

BY CHARLES P. STEINMETZ.

I.

Electric energy is not a primary energy; that is, it is not found in nature, nor directly producible to any appreciable extent from the stores of energy available in nature—water power and the energy of fuel. To become available for conversion into electric power, the energy found in nature must first be converted into mechanical rotation by some form of prime mover. The engineering characteristics of these converting apparatus may be classed under two main groups, those referring to economy and reliability, respectively. In both, the electric machine, whether generator or motor, ranges very high; its efficiency is virtually unity; its size, first cost, and maintenance small; its reliability great. In the cost of electric power the electric machine plays only a subordinate part; the essential element in determining the cost and the reliability of electric power is the prime mover; that is, the intermediary step between nature's stores of energy and the dynamo shaft.

The cost of electric power consists of three parts.

A. The fixed cost or permanent cost; that is, the cost depending on the size of the station, but not on the amount of power supplied by it.

B. The proportionate cost; that is, cost proportional to the amount of power delivered.

C. The reliability insurance; that is, the additional cost required to assure the desired reliability or continuity of service.

A. Fixed Cost.

1. *Interest on the investment in the plant.* This factor varies very greatly with the form of the available energy. It is frequently very large with water power, due to the hydraulic development required—dams, pipe-lines, land to be flooded for water storage, power stations and prime movers, transmission lines, etc.

It also depends on the prevailing rate of interest; on local conditions—whether a market is waiting for the power and capital for the development easily obtained; whether a market is within reach and can be developed; or whether a market has first to be created.

2. *Depreciation of the plant.* This factor is different for different parts of the plant. For instance it is very low for buildings and for line copper; it is high for apparatus such as railway motors, which by the nature of their service operate on a narrow margin.

In considering depreciation, the "useful life" of the apparatus may often be much shorter than the total life. . The ratio of the useful life to the total life varies with different apparatus. Electrical machines and prime movers and other parts of the plant, for instance, may still be in condition to give many years' service, but nevertheless their further use is uneconomical. Their useful life is thus ended. This condition may be due to the advance of the art, which makes other types of apparatus so much more economical that the cost of the difference in economy properly capitalized exceeds the cost of reconstruction of the plant. It may be due to the fact that with the increase of the market the size of units initially chosen may have become too small, or the space-economy too low, or the voltage too low for economy. Furthermore, the cost of attendance or of maintenance may be so much lower with the more modern apparatus as to make it uneconomical to retain the existing plant.

Just as it was realized many years ago that with the incandescent lamp there was a difference between the total life and the useful life, that after a definite period it did not pay to maintain incandescent lamps in service, even if still operative; so with all engineering apparatus a similar "smashing point" exists, a point where economy requires renewal of the plant, even if still operative. At this point the useful life of the old plant ble—either by use as reserve plant, or to take care of peak loads,

[1]Extract from a paper presented at the meeting of the American Institute of Electrical Engineers, New York, February 19, 1909.

is ended; it should be thrown out with whatever salvage is feasible or to be operated elsewhere when space economy limits the useful life. In considering depreciation, the useful life of the apparatus should thus be considered.

3. That part of the operating expense which does not depend on the use of the plant, as superintendence, some supervision, etc., such repairs as maintenance of dams and hydraulic development, etc.

B. Proportionate Cost.

1. This comprises the cost of energy and accessories to its conversion—fuel, condensing water and lubricating oil in thermodynamic engines, water (where a charge is made for the water power) and oil in hydraulic plants, etc.

2. Labor and attendance, including that part of supervision which varies with the power utilized.

3. Maintenance, repair and depreciation of the plant, as far as they depend on the use of the apparatus; for instance, brush renewals, commutator repairs, railway motor depreciation, etc.

C. Reliability Insurance.

1. This comprises the overload capacity of apparatus in power, voltage, etc., provided to take care of emergencies.

2. Duplication of parts of the plant, as reserve units, duplication of exciter plant, of lines, and feeders, etc.

3. Additional plant, as steam reserve with water-power plants, storage-battery reserve, tie lines with other systems, etc.

Some of the items of the cost may belong partly in one, partly in the other class; depending on local conditions, it may properly be chargeable to either one or another subdivision. For instance, the cost of developing water storage would belong under *A*, if the power capacity of the plant depends on it, while it would be chargeable to reliability insurance *C*, if provided to guard against failure of the power in unusually dry seasons.

The relative weights of *A* and *B* depend largely on the load-factor; that is, the ratio of the average to the maximum power. With a poor load factor, item *A* is far more important. It recedes in importance with the improvement in the load-factor.

Attention is drawn to the recognition of Class *C*, the reliability insurance, as a distinct and essential part of the cost of power, separate from *A* and *B*. Item *C* again consists in part of the character of fixed cost, and in part of the character of proportionate cost. Nowadays, when the lay public is interested in the cost of electric power, and is comparing plants which may be very different in regard to reliability of service (as supply from a water power over a single transmission line without steam reserve compared with a city steam station with storage-battery reserve), it appears desirable to recognize the insurance of continuity of service as a separate part of the cost of electric power.

The great difficulty met with in discussing reliability of service is the absence of an established standard; for what one engineer may consider as perfectly satisfactory service, may be considered as entirely unsatisfactory by another engineer.

A classification of electric power supply regarding its reliability may be made by the number of shut downs per year. Four classes of shut downs may be distinguished, by the time of their duration:

a. Less than one second; that is, less than the time which would throw synchronous apparatus out of step. A few seconds' failure of power in the supply of a synchronous motor or converter means re-starting and synchronizing, and thus for the power users depending on the synchronous machine represents a very much longer shut down.

b. Less than 20 minutes; that is, the time in which synchronous appartus in a well organized plant can be put back into service. In lighting circuits, while the failure of the lights is annoying, it is not usually serious, and the loss of time by failure of the power supply is moderate.

c. Less than three hours; that is, the time sufficient to start anew a steam plant, replace or repair damaged apparatus as transformers, repair lines, etc., and a time which, if the shut-down occurs only rarely, in general does not warrant the installation of a separate system of light and power supply, as gas or a private steam plant.

d. More than three hours. This represents a complete break down of the system. If this is likely to occur, it requires the provision of private lighting or power plant service wherever power is used from the electric supply system.

In estimating the reliability of service the shut down of a part of the system would be considered as a part of a shut down, in proportion to the connected load. Thus a shut down of a section comprising $1/n$ of the total connected load of the system would count as $1/n$ of a shut down. This method of counting gives the average number of shut downs per customer.

Voltage variation beyond the limits permissible in good service—about 2% in lighting, and 10% in power supply—would be considered as a partial shut down, about in the following manner:

A voltage variation of 2 per cent to 10 per cent as one-tenth of a shut down in a lighting system, but does not count in a power-supply system.

A voltage variation of 10 per cent to 50 per cent as one-half of a shut down.

A voltage variation of over 50 per cent counts as a complete shut down.

It appears reasonable to omit from consideration any shut-down made for purposes of change, repair, etc., provided the users have been notified beforehand.

By the yearly number of shut downs, an electric power supply would be classified as:

1. First class service:

$a<4$ per year; $b<1$ per year; c and d absent.

2. Good service:

$a<12$ per year; $b<4$ per year; $c<1$ per year; d absent.

3. Second class service:

$a<52$ per year; $b<12$ per year: $c<4$ per year; $d<1$ per year.

4. Third class service:

$b<52$ per year; $c<12$ per year; $d<4$ per year.

5. Unsatisfactory service, suitable only as auxiliary power, etc.

Some such schedule of classes of service appears urgently needed, to give a meaning to statements and discussions on character and reliability of service.

The above proposition is probably the best that can be expected at present, without putting too large a majority of the electric systems into the second and third classes. It must be realized, however, that the standard set by it is far lower than that maintained in most gas or water supply systems; that what is here called good electric service would be entirely unsatisfactory in a gas service. However, this lower standard is permissible, due to the far greater safety of electric power, in which case a temporary interruption of the supply is not liable to such disastrous results as would be the case with gas service.

II.

In discussing the features of prime movers it is necessary to distinguish between those which are inherent in the type of apparatus — as the dependence on meteorological conditions in the hydraulic plant, the high temperature in the gas engine—and those which are incidental. The incidental features are due to the particular form of design, and therefore defects from this cause are usually temporary. While a defect in the prime mover may be just as serious to the operation of the plant, even if not inherent in the type of apparatus, in a comparative discussion such features cannot be given the same weight, as they are not permanent. They are eliminated with the advance of the art, or avoided when recognized; as, for instance, the difficulties found with the convection of superheated steam, due to the considerable expansion and contraction of piping caused by the high temperature differences.

Most of the features of prime movers pertain either to economy or to reliability.

A. Economy.

1. *Power of economy or efficiency.* With a thermodynamic engine the total efficiency is the product of mechanical efficiency, thermodynamic efficiency, and producer efficiency. The thermodynamic efficiency is the ratio of the available energy in the engine to the total heat energy supplied to it. The mechanical efficiency is the ratio of the mechanical output at the engine shaft to the available energy in the engine. The producer efficiency is the ratio of the total energy of combustion of the fuel to the heat energy supplied to the engine; it thus comprises furnace efficiency, boiler efficiency, superheater efficiency in a steam engine, or producer efficiency in a gas-producer plant, etc.

The thermodynamic efficiency depends essentially on the temperature range utilized by the engine, and to a lesser extent on the thermodynamic cycle used by it. It increases with increase of the temperature range.

The mechanical efficiency depends on the size per kilowatt output of the cylinder volume, on the temperature range, the pressure and the pressure differences, the momentum of the moving parts, their velocity and the nature of the velocity, whether reciprocating or rotating, etc. In general it decreases with increasing size and mass per kilowatt, with increasing speed, (especially when reciprocating) and with increasing temperature and pressure differences. It thereby depends largely on the available energy per unit volume and per unit weight of the working fluid.

Consideration of the producer efficiency opens such a wide field as to be beyond the scope of this paper.

As the cost of the energy is only a part of the proportionate cost of power, the importance of the efficiency varies with the proportion which this part of the cost bears to the total cost. It thus depends upon numerous considerations—the size of plant, load-factor, etc. In general, high engine efficiency increases in importance with increasing size of plant, and with increasing load-factor, and in such plants becomes the most important factor. In small plants with a poor load-factor it may drop into secondary rank, compared with the fixed cost A, and the cost of maintenance and repair, especially if in the design of the plant the mistake is made of giving too much attention to high efficiency, and thereby too little to reliability and low maintenance.

2. *Space economy.* This factor depends essentially on the engineering skill and judgment in the design of the plant, and on the type of the prime mover. It affects the fixed cost of power, and varies greatly in importance; for instance, space economy in the hugs plants of our large cities is of very great importance, while for smaller country plants, or plants in locations where unlimited space is available, it becomes of very little importance.

3. *Investment economy.* This depends largely on the available market, and the desired quality of the power. It affects the choice of the prime mover; for with an assured market, requiring a high grade of service, the large investment of a first-class modern plant with the best type of prime movers and ample reserve is most economical. In many of the earlier railway plants the conditions were such that single-cylinder, non-condensing engines of the cheapest type gave the most economical and occasionally the only feasible arrangement. But even in the large first-class plants, in those parts of the plant that are only occasionally called upon for service; that is, which have a very low load-factor, good judgment may suggest a cheaper and correspondingly less efficient type of apparatus than would be economical in the engines which are continuously in service. Such a reserve and emergency plant thus offers a means of utilizing machinery which in the main plant has finished its useful life. To some extent this applies to the thermodynamic reserve of a water-power plant, especially where it is only rarely called into service, and economy in first cost and in space and simplicity may far outweigh high efficiency.

4. *Labor economy, as determined by the amount and character of attendance required.* With a high price and poor quality of skilled labor, prime movers which require a higher grade of attendance become less economical than less efficient prime movers which can be operated by unskilled labor, or require only very little of skilled labor, and especially in our country, the reduction of the amount of high-grade skilled labor is economically necessary. It is this feature which has forced the designers of prime movers and electrical apparatus to devote their attention chiefly to make the apparatus as "fool-proof" as possible, even if efficiency and other characteristics have to be sacrificed to some extent. This fact has to a considerable extent determined the trend of development of the industry, so that types of apparatus which have proved entirely satisfactory in other countries were a failure here, until they had been re-designed to meet the requirements of being operated by the available class of labor. A characteristic instance of the effect of price and character of labor is the general introduction of the enclosed arc lamp in this country, while abroad the open arc is universally used. There the enclosed arc has never been accepted, due to its lower efficiency. As a result, the experience gained abroad with different types of prime movers and other apparatus is not directly applicable in our country, and conversly.

5. *Maintenance, repair, and depreciation.* This depends largely upon the type of prime mover, and in thermodynamic engines on the cycle used in the engine. Higher temperature differences, greater cylinder volume and piston pressure, heavier moving (especially reciprocating) masses, higher speeds (especially of reciprocating masses); in short, greater mechanical and temperature stresses in general, other things being equal, tend to greater maintenance and repair cost and more rapid depreciation. Thus this item is to some extent proportional to the mechanical efficiency, and inversely proportional to the thermodynamic efficiency of the engine cycle.

The economic item of depreciation depends, however, not only on the wear of the apparatus, but also on the limitation of its useful life. In this respect it must also be kept in view that with apparatus which is in a state of rapid development, as the steam turbine or the gas engine, the useful life should be expected to be shorter than with apparatus in a field in which no great development occurs. With a rapid advance in the development the time soon arrives where older apparatus is so far left behind as to make it more economical to replace it. This has been well illustrated by the history of the electrical industry. It would be an argument against the use of newer types of apparatus, and thus antagonistic to progress, if it were not for the fact that in the types of apparatus with which the new development competes the useful life is shortened in the same or probably still a greater degree, as either an extra rapid advance in their design must occur to meet the competition, or they would be replaced by newer types. Thus the useful life of the steam turbine, due to its rapid advance, must necessarily be shorter than the life of the steam engine would be if there were no turbine or gas engine; but due to the existence of steam turbines and gas engines, the useful life of the steam engine, as limited by the advance of the art, is correspondingly shortened, as it faces displacement by turbine or gas engine or also has to advance more rapidly.

It will be seen, therefore, that in the economic characteristics of thermodynamic prime movers in general, efficiency and the other features are to some extent mutually conflicting. Engineering judgment must therefore decide on the relative weights of the different economic factors which enter the choice of the prime mover in the individual case under consideration.

B. Reliability.

Features, which are of importance for the reliability; that is, continuity of service, are:

1. The absence or presence of exernal influences beyond the control of the operating force, as meteorological effects, etc.

2. The design of the plant. This is an engineering problem outside of the scope of this paper. It is obvious, however, that an error in the design can rarely be remedied afterwards; therefore, before the plant is constructed and before the buildings are designed, the arrangement of prime movers and electrical apparatus should be designed to afford the greatest safety of

operation. Frequently this has not been done. The architect of the buildings has overlooked the fact that the switch-boards and controlling devices of our modern large, high-voltage electric plants require considerable space, and such apparatus—on which the safety of the system depends—has been crowded together in an altogether insufficient space, to the great detriment of the reliability of operation of the system. A marked improvement has taken place in this direction in the last years.

3. The probable frequency of shut down of the prime mover, and the liability of involving other machines by it, and the number of other units and reserve plant available. To some extent this depends on the mechanical and temperature stresses in the prime mover; it is related to the economic item of maintenance, repair, and depreciation.

4. Rapidity of starting of apparatus, and getting them into service, to cope with emergencies as a shut down of the system or a part of it, as a break down of a transmission line or feeder, an accident to one or several units, etc., or even an unexpectedly rapid increase of load, and rapidity of reaction to changes of load; that is, speed regulation and voltage regulation, etc. These are important features in their effect on the reliability of service. They depend to a considerable extent on the type of prime movers and other apparatus, but to a still greater extent on the preparedness for such emergencies, and the organization of the operating force for it.

PRELIMINARY CENSUS REPORT ON TELEGRAPHS.

The statistics relate to the years ending December 31, 1907 and 1902. The totals include reports of commercial land telegraph companies owned and operated within the United States, and of domestic ocean cable companies operating from the United States, but do not include telegraph lines operated by railway companies.

	1907.	1902.	Per cent of increase.
Number of systems or companies	25	25	0.0
Miles of single wire (exclusive of ocean cable)	1,577,961	1,318,350	19.7
Nautical miles of ocean cables	46,301	16,677	177.7
Messages, total number	103,794,076	91,655,287	13.2
Total income	$51,583,868	$40,930,038	26.0
Total expenses (including taxes, interest and fixed charges)	$41,879,613	$30,948,034	35.3
Total cost of construction and equipment (including real estate)	$210,045,959	$161,679,579	29.9
Capitalization:			
Capital stock authorized, par value	$16,603,900	$123,233,075	31.1
Capital stock outstanding, par value	$155,089,575	$117,053,525	32.5
Dividends on stock	$7,477,083	$6,256,693	19.5
Bonds authorized, par value	$83,004,000	$49,893,000	66.4
Bonds outstanding, par value	$65,204,000	$45,893,000	42.1
Interest on bonds	$2,651,511	$1,949,150	36.0
Total par value stock and bonds outstanding	$220,293,575	$162,946,525	35.2
Employees and wages:			
Average number	28,034	27,627	1.5
Total salaries and wages	$17,808,249	$15,039,673	18.4

The final report for 1907 will contain an analysis of the above totals and present detail statistics for other phases of the industry.

Standard specifications for coal are being investigated by a committee of the American Society for Testing Materials. Dr. J. A. Holmes, of the U. S. Geological Survey, Washington, D. C., is chairman of the committee and B. F. Bush, president Davis Coal and Coke Company, Baltimore, Md., secretary. A classification of the users of coal who can properly purchase under standard specifications includes, (1) Steam plants; stationery, power, locomotives, ships, naval, etc. (2) Producer gas. (3) Domestic coal; low-pressure heating plants, anthracite, bituminous and coke. (4) Metallurgical; coke, smithing. (5) Gas (illuminating). (6) Cement and miscellaneous drying operations. Sub-committees have been appointed to consider specifications for each of these classifications and report to the general committee next June, when the society holds its annual meeting at Atlantic City.

REGULATION OF GAS SERVICE.

In the course of a report on the question of suitable regulation of gas service for Chicago, submitted to the Committee on Gas, Oil and Electric Light, William B. Jackson finds several factors that must be given careful consideration in the formulating of rules for the regulation of gas supply, and each of these is considered under a seperate heading in the following:

The Heating Value of Gas.

From fifty to ninety per cent of the gas burned in the larger American cities is used in such manner that the heating quality of the gas is the active agency. This proportion includes gas burned for cooking and commercial heating purposes, and also gas used in illuminating devices where the light emanates from an incandescent element or mantle such as is found in the ordinary Welsbach burner. From this it will be seen that the question of calorific or heating power of the gas must be a highly important factor in determining the value of gas for use in heating and lighting.

By reference to the data already referred to and from a general study of the subject, it will be found that a mantle burner (wherein the heating power of the gas is made direct use of) will give from three to five times the amount of illumination per cubic foot of gas that is usually obtained from an open flame burner wherein the illuminating or photometric value of the gas is the active agency; and consequently, under most conditions where gas is used for long time burning or where there is any great amount of illumination required, the open flame burner should be displaced by the mantle burner. The advantages to be gained by the use of incandescent mantle burners wherein the heating quality of the gas is of paramount importance is not now fully recognized, but as the economy in gas consumption of the incandescent mantle becomes more universally appreciated and the cost of the mantle becomes less, the tendency will be for the value of the gas used for illuminating purposes to become more and more dependent upon its heating power. Four of the cities and states whose code of rules are included in the tabulations heretofore referred to, now make heating power an important test of the value of gas.

Illuminating Value of Gas.

In the code of rules for gas supply recently promulgated by the commission having such matters in charge in the State of Wisconsin, illuminating power of the gas is not prescribed for the present, while the heating power has been given prominence. We believe that the heating power should be given an important place in the rules in order that the best results from the gas service may be obtained in Chicago, but we do not believe that the illuminating value should be ignored. Many consumers of gas regularly use some type of open flame burner, and convenience dictates such use in many instances. And we therefore feel that the question of photometric or illuminating value of the gas should not be lost sight of in a code of rules for Chicago.

Impurities in Gas.

It is important that gas should be free from certain impurities, and should at no time have an excess of other impurities. Owing to the poisonous nature and extremely unpleasant odor of hydrogen sulphide, never more than a trace of this compound should be present in the gas; also the presence of sulphur in any other compound should be limited by the rules, and the same may be said of ammonia. There is some question regarding the amount of either sulphur or ammonia that should be allowed in gas, though the limits seem to be pretty well determined by existing practice.

Fluctuations in Pressure of the Gas.

It is impracticable to design a system for the distribution of gas wherein the pressure will remain constant at all periods of the day and night, and the question of the fluctuation that may be practically allowable is difficult of solution.

For any fixed adjustment of a gas burner the rate of consumption of gas varies with the pressure and there is one rate of consumption at which the gas is used most economically. Therefore the interests of most satisfactory service require that the

variations of pressure be kept as small as practicable. On the other hand, it is probably equally true that maintaining the gas supply over a great gas distribution system such as is found in the City of Chicago, allowing only small fluctuations of pressure, is one of the difficult problems a gas company has to face.

Some cities require that the fluctuation in gas pressure shall not exceed a definite amount at the inlet of the consumer's meter. Such a requirement appears to us to be unwise. It is possible to arrange a gas burner for economical operation when the supply pressure at the meter inlet is high and equally possible to arrange it for economical operation when the supply pressure is low (provided it is not too low). This may be accomplished by means of the burner cock or by the introduction at the burner of an orifice or check of the proper size to permit the appropriate amount of gas to flow to the tip of the burner or to be distributed to the incandescent mantle. In other words, the flow of gas to the burner must be the same whether the pressure is great or small at the meter inlet, to obtain economical results. But the flow of gas through a burner of fixed adjustment is dependent on the supply pressure,and the deviation from the best economy is therefore dependent on the percentage fluctuations of pressure of the gas supply. It is therefore apparent that the allowable fluctuations should be fixed on the basis of a percentage of the lowest pressure ever reached at each point considered. The lowest pressure here referred to must not be confused with the minimum allowable pressure on the system. This plan is followed in the code of rules for gas regulation recently promulgated by the commission in the State of Wisconsin, in which code a daily variation of 100 per cent of pressure at any point is allowed above the lowest pressure reached at the point.

From the above considerations it will be appreciated that a stable pressure is of much importance in the production of satisfactory gas supply.

Minimum Allowable Pressure.

The matter of allowable fluctuations in pressure being suitably dealt with, it is necessary to consider what the minimum allowable pressure may be. To afford satisfaction, it is essential that enough gas pressure shall be provided at the burners to send forth sufficient gas for the proper operation of the burners. If the pressure drops too low for any given type of burner, it is impossible to adjust the burner to give economical results. It is, therefore, important that a definite minimum shall be fixed below which the gas pressure shall not be allowed to go.

Maximum Allowable Pressure.

We are of the opinion that the question of the maximum pressure reached by the gas supply is not a very important one. There appears to be serious question whether, in the present state of the art, any maximum gas pressure should be fixed. There is no greater difficulty in obtaining good results from a properly constructed burner when the pressure at the meter is high than when the pressure is low.

However, many gas consuming devices require a very low gas pressure at the burner outlet to give most economical results, such pressure ranging from a fraction of an inch to two and one-half inches of water pressure, according to the burner (one inch of water pressure being less than four-hundredths of a pound per square inch). Also, most gas consuming devices are manufactured with the expectation of quite a low pressure at the meter inlets, so that some consumers will find it difficult to obtain satisfactory service from their burners with high pressures at the meter inlets unless necessary provisions are made for throttling the gas before it reaches the burner. Under these circumstances, it would seem that the Gas Company should be expected to provide consumers now equipped with such burners with satisfactory service by adjusting their burners, and where necessary, provide the requisite checks at the burners to suitably reduce the pressure.

Location of Testing Stations.

We are informed that the gas company supplying gas service to the City of Chicago owns seven operating gas plants to provide gas consumed in the city. Three of these plants are located in the northeastern portion of the city and at a maximum of a mile and a quarter apart, and a minimum of three-quarters of a mile apart. Three of them are located in the eastern-central portion of the city at a maximum of a mile and a quarter apart and a minimum of about one-half mile apart, while the seventh is located in the far southeastern portion of the city, approximately nine miles from the nearest of the other stations.

The plans of the piping show all of the gas plants inter-connected upon the gas distribution system of the company, and some of them are so inter-connected that it would be substantially impossible to locate a testing station so that it would be sure to receive gas coming from only one of the plants unless the testing station was located immediately adjacent to the gas plant. This condition is exaggerated by the location of the gas storage reservoirs at different points in the city. It, therefore, seems that gas testing stations should not be located with sole reference to individual gas plants, but should be so placed that the gas received at each of the testing stations would be a fair average of the gas distributed in the district in which the individual station is located. That is, the effort should be made to test the gas in districts, rather than as it is supplied by the individual gas plants. Even with the most judicious locations of the gas testing stations, it is desirable that the tests made at such stations should be supplemented by testing samples obtained at different other points in the district in which the station is located.

It would seem that seven stations would satisfactorily cover the territory included in the gas distribution system in the city if the work at these stations is supplemented by samples as heretofore described.

Equipment, Size and Cost of Stations.

To make these testing stations most suitable for the purpose in hand, it would be desirable that each testing station should be equipped with a standard calorimeter for determining the heating value of the gas together with the necessary supplementary apparatus; with a standard photometer, having the necessary standard meters and standards of illumination for providing facilities for exact measurement of the illuminating value of the gas; with the necessary standard apparatus for determining the amount of hydrogen sulphide, sulphur and ammonia in the gas; with a recording pressure gauge, and "U" tubes for measuring the pressure of the gas, and miscellaneous equipment; and with at least three recording pressure gauges, by means of which the pressure of the gas may be determined continuously,—the recording meters to be placed at different points on the gas supply system outside of the testing stations, and their locations change from time to time. And for use in connection with all of the stations at least two gas analysis apparatus for complete analysis of the gas should be provided so that from time to time samples of gas could be fully analyzed.

Each station can be suitably housed in a room not larger than 14x18 feet, and the cost of the equipment of each station complete connected ready for operation should not amount to over $1,500.00.

Labor Required in Operating Stations.

Not over four men giving their entire time and attention to efficiently operating the seven stations as above enumerated including attention to the recording pressure gauges and to making tests of gas from various points on the gas supply system, should be able to obtain tests that would provide ample knowledge of the characteristics of the gas supply, such as would be necessary in determining whether every part of the city receives gas of suitable quality and pressure for satisfactory service.

In the above we have set forth the general conditions affecting the subject of the gas regulations with the object of pointing out the requirements that must be met to provide satisfactory gas supply, and in the following we give what we believe would be fair rules for gas regulation from the standpoint of the consumer of gas and from the standpoint of the company furnishing the gas.

Impurities.

Hydrogen Sulphide; Not more than a trace should at any time be found in the gas.

Total Sulphur; The amount of total sulphur should always be kept below a definite limit. Present practice indicates that the maximum allowable total sulphur should not be greater than thirty grains per one hundred cubic feet of gas, and we believe that for the conditions in the City of Chicago, twenty grains of sulphur per one hundred cubic feet of gas should be the maximum limit.

Ammonia; The amount of ammonia in the gas should also be kept below a definite limit. Present practice indicates that this limit should not be greater than ten grains of ammonia per one hundred cubic feet of gas, and we believe that ten grains per one hundred cubic feet would be a suitable limit for Chicago.

Illuminating Value of Gas.

We believe that the illuminating value of the gas in Chicago should at no time fall below twenty-two candle power when burned at the rate of five cubic feet of gas per hour as provided in the existing Chicago ordinance.

Heating Value of Gas.

We believe that the heating value of the gas in Chicago should not be permitted to fall below 600 British Thermal Units gross per cubic foot of gas.

All results given above are to be understood as applying to standard conditions of temperature and atmospheric pressure, namely 60 degrees Fahrenheit and thirty inches barometric pressure.

Pressure Fluctuations.

We believe that the maximum allowable variation of pressure at the inlet of any meter in Chicago should not be greater than 100 per cent of the minimum pressure found at any time at that meter, except that it should be one duty of the chief gas inspector to set a new minimum limit upon the written request of the gas company when the conditions affecting the minimum pressure change owing to the growth of the gas system or to development of the art; such changes to be made not oftener than once in six months. We understand that it is impossible at the present time for the gas company to maintain the gas pressure within such limits at all points upon their gas supply system. It would, therefore, seem that regulations relating to this feature of gas supply cannot be effective until the requisite changes have been made in the gas distribution system. In the meantime, we believe that the company should, upon the complaint of any consumer, at whose meter there is a greater variation than 100 per cent of the minimum pressure, adjust his gas consuming devices so that the gas service is satisfactory to him, or should provide a local governor to hold the variation in pressure at the meter within the above prescribed limits.

Minimum Pressure.

The allowable pressure at the inlets of consumers' meters should never become less than a definite amount. Present practice indicates that one and one-half inches of water pressure, at the street level, is a satisfactory minimum limit, and we believe that such a minimum would be a suitable one for the City of Chicago.

Maximum Pressure.

Our study of the question of gas pressures leads us to the belief that it is not desirable at the present time to set any hard and fast maximum allowable pressure in Chicago; but, owing to certain conditions heretofore explained, we believe where consumers now have gas consuming devices installed that will not suitably operate with pressures of over six inches at the inlet of the meter (located at the street level) that the gas company should adjust the consuming devices so that they will operate satisfactorily when the pressure rises above six inches.

Tests for Pressure.

We believe that in addition to the pressure measuring devices in the testing stations there should be at least three seven-day recording pressure gauges for each testing district to be located at various points over the district in which a testing plant is situated and the locations to be changed from time to time. Such testing gauges to be of the line drawing kind which show the pressure of gas at every instant and each chart to be arranged to show the pressure continuously for seven days.

Tests for Thermal Value and Candle Power.

We believe that besides the tests to be regularly made in the testing stations for heating power, additional tests should be made from time to time of gas taken at various points in each of the districts, and occasionally tests for candle power should be made as well as for heating power.

Complete Analyses of Gas.

From time to time complete analyses of the gas should be made in each testing station, and whenever tests for calorific value of gas are made at points outside of the stations complete analyses of the gas found at these points should be made.

Frequency of Tests.

We believe that tests for the candle power, thermal value, and the presence of hydrogen sulphide, in the gas, should be made daily, excepting Sunday, in each testing station, and the tests for ammonia and sulphur should be made weekly, while the recording charts of the various continuous pressure gauges should be changed weekly. The additional tests for thermal value and candle power of gas taken from outside points should be made from time to time as may be found necessary for a complete determination of the quality of gas as supplied throughout the city. Also the complete analyses of the gas should be made with sufficient frequency to properly supplement the other tests.

Rules as above proposed, if carried out by the gas company, will in our opinion, assure a satisfactory gas supply to the City of Chicago, and the operation of the testing stations and other supervisions outlined, when the work is carried out in the above described manner, will give the city all information needed for enforcing the rules.

Natural gas says Consul-General William H. Michael of Calcutta, issues from a crevice in the ground 20 miles from Chittagong. It has been burning so long that the oldest inhabitant can give no idea of when or how it was set on fire. The general belief among the natives is that the gas has been on fire for centuries. It is now suggested—and some steps have been taken to carry out the suggestion—that the fire be extinguished and the gas be brought under control and piped down to Chittagong for lighting and fuel and power purposes. The citizens of Chittagong have concluded that it would be cheaper to utilize the gas than to introduce electricity for fuel, power and lighting.

The Department of Electricity, San Francisco, is housed in a two-story brick building at 55 Fulton street. In the repair shop are built repeaters, tapper and alarm switches, telegraph keys for the switchboards, and other pieces required to keep the fire alarm system in repair and perfect working condition. The central fire alarm station is furnished with the latest appliances and is better equipped than ever before. The "Joker Signal" system, which was placed in operation for the first time in this city last October, has proved of great advantage, as it affords a quick method of giving information to the fire department of the movements of all fire companies. These reports are transmitted in the same manner as fire alarms. Another important addition to the fire alarm system has been the installation of a private exchange telephone system, which connects all of the fire houses with the central alarm station, thus giving the fire department independent control of all department telephones.

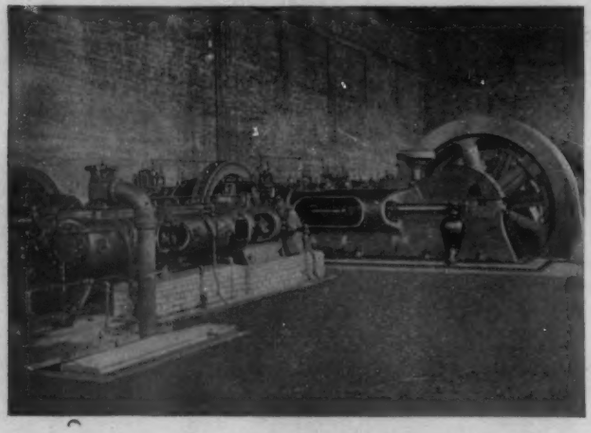
THE ECONOMY OF ELECTRIC DRIVE AS APPLIED TO BRICK AND TILE PRODUCTION.[1]

BY E. A. LOF.

The question of the advisability of electric drive in brick and tile factories may at the present be regarded as decided in the affirmative. There are a great many points that affect the character of power distribution, and in addition to the saving in cost of supplying power to the productive machinery, all these other factors should be given due consideration. The satisfactory and economical handling of raw and finished material, reliability of service and the preventing of injury to individuals must also be looked out for. Future expansions of the plant should be made possible without undue rearranging the original equipment.

The electrical distribution of power so fully meets the requirements of brick factories that it has become recognized as pre-eminent for use in large as well as in smaller plants.

In making a choice between the various means for power distribution, a manufacturer should naturally bear in mind the effect that the various arrangements may have on the several elements that enter into the manufacturing cost. Manufacturing requirements demand the earning of dividends and this in turn necessitates that the product shall be turned out at the least total cost.



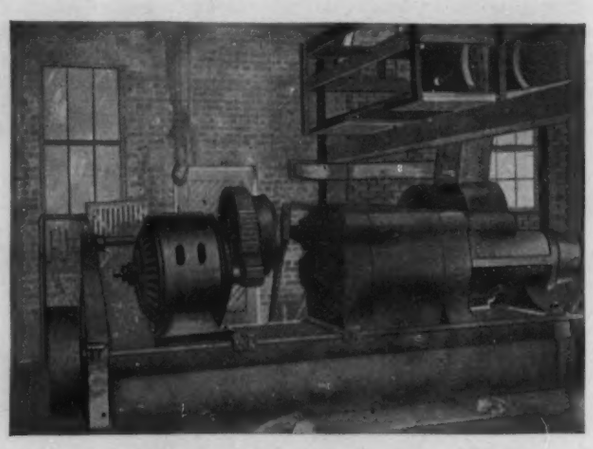
Power Plant of Columbus & Hocking Clay Construction Company at Kachelmocker, Ohio.

A mechanical system of driving is, besides inefficient, also inelastic. As machines are added time and again, the shafting, bearings and hangers become so strained and twisted that it is a wonder that they do not break down altogether. Our electric system, on the other hand, is perfectly elastic. Motors can be added from time to time without in any way affecting the efficiency of the system. Machines can be put in positions, which would be impossible if they were driven by means of belting, and besides this, a perfect control of the individual machines is made possible with the electric system.

The fact, however, must never be overlooked that the generation of electricity by steam power must necessarily be dearer at the generator than the steam power itself. It is in the method of transmission and application that electricity scores and by installing the motors right near the productive machines, avoiding all unnecessary losses, can we secure the highest economy and beat commercially every other method of driving.

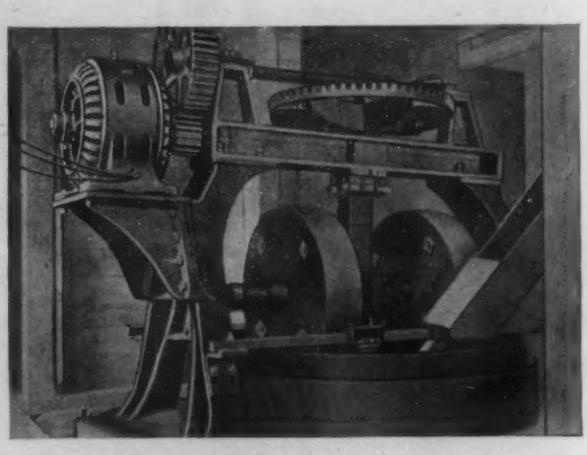
The first cost of the power generating and distributing system is often of less importance as compared with other factors, which is, however, not the case in regard to the efficiency of the system. The losses in the distributing system naturally affect the size of the generating plant and the value of this lost power is an item of great importance. With mechanical drive, these losses are constant as long as the shafting is running whether the productive machinery is running or not. This, is, however, not the case with electric drive as at no load when the motors are not running there is no loss taking place in the system.

An accurate knowledge of the absolute loss of power in driving shafts and belts would be of great value in determining the exact gain that would be affected if electric drive was substituted for mechanical drive. There has, however, been many tests made to determine these losses and it has been shown with



Induction Motor Driving Dry Pan.

the plant running *at full load* it will range from 30 to 60 per cent; an average for clay working plants being 40%. Should only a few machines be running the losses may of course come up to 75 or 80% of the generated power or in other words, four-fifths of the coal consumption is wasted in friction losses. With the electric drive the losses are easily determined and will not exceed 25% of which 12% is consumed in the motors, 5% in the wiring and 8% in the generators. With the electric system it is possible to insert indicating instruments in the various circuits and a complete check can at all times be had on the power consumed by the various machines. This is particularly valuable in testing departments in order to determine the power required for driving brick machinery for different sorts of clay.



Induction Motor Driving Brick Machine.

The advantage of electric drive is especially apparent where the conditions demand the location of the powerhouse at a distance from the manufacturing buildings. Also when cheap electric power can be purchased from an electric power company, the value of electric drive is still further accentuated. In such cases the power is supplied over long distance transmission lines

[1]Read before the Iowa Brick and Tile Association, Mason City, Iowa, January 14, 1909.

at a high voltage, which is stepped down at the manufacturing centre to a pressure adopted for the motors.

The alternating current three phase system is probably the best adapted for brick factories. This system consists of a three phase generator composed of a stationary and a revolving part, an exciter for delivering the magnetizing current for the generator fields, a system of distributing wires and motors.

The alternating current system is simpler than the direct current system in that no current has to be delivered to the rotating armatures of the motors through carbon brushes and a commutator. This commutator is the main difference between alternating and direct current motors. The brushes and the commutators are the only parts of the direct current motors in which trouble is liable to arise due to accumulation of dust and dirt. The simplicity, durability and freedom from break-downs, are therefore, the main advantages of the alternating current motor. The pressure best suitable is 220 volts as the danger by coming in contact with the wires is not very great and as this pressure can directly be used for the lighting system, which in all cases naturally is provided. Where very large motors are used, it may be advisable to use a pressure of 440 or 550 volts as with this voltage the size of the wiring can be considerably reduced. Step-down transformers for the lighting system will, of course, have to be provided in such a case.

The frequency of the system is usually 60 cycle as the same gives good lighting results, at the same time not causing any excessive inductive effects. The three phase system has the advantage over the two phase in that the wiring is simpler and in that the amount of copper required for the distributing system is less.

For driving brick machinery, where a high starting torque is required, the induction motors with phase-wound secondaries will exactly meet the conditions. The secondary winding itself has a very low resistance, which means high efficiency and good regulation. By the insertion of external resistance in the secondary winding the motor will be able to develop maximum torque of at least two times the normal running torque. Each motor should be provided with its own starter complete with overload and no voltage features. The former device will disconnect the motor on heavy overloads and the latter will disconnect the motor if the plant for some reason is shut down.

The operation of every machine and conveyor by its own motor produces a very satisfactory appearance but it may not return the most economical result. Very small motors are not so efficient as larger ones and besides they are more expensive per unit of power. For this reason it will frequently be found advisable to drive a group of smaller machines with one motor of a large capacity providing that the shafting for these machines does not become too extensive.

An example showing the actual saving of an electrically driven plant as compared to a mechanically driven one may prove of interest. Through the courtesy of the American Clay Machinery Company of Bucyrus, which company has installed several very successful electric driven plants, I have been fortunate to obtain data that will give a very accurate idea of the saving that can be accomplished.

Assume a brick plant with a yearly production of 25,000,000 bricks, which has to be equipped with the following productive machines:

1 Brick Machine, consuming	75 h. p.
1 Pug Mill	50 h. p.
3 Dry Pans, each	35 h. p.
Represses and Cutters	35 h. p.
Elevators	20 h. p.
Conveyors	8 h. p.
1 Exhaust Fan	50 h. p.
1 Disc Fan	10 h. p.

This will total approximately 350 h. p., the fans running 24 hours, but all of the other machinery only 10 hours per day.

Steam Driven Plant With Shafting.

The average load during the period when the plant is running will be approximately 85%.

Cost of Installation.

1 600 h. p. Boiler Equipment, complete with stack, pumps, piping, etc.	$ 9,000 00
1 400 h. p. Engine	4,500 00
1 60 h. p. Engine	2,200 00
1 15 h. p. Engine	600 00
Belting, Shafting, complete	2,500 00
Total cost of installation	$18,800 00

Horse power hours produced per year:

400 h. p., 85%, 10 hours, 300 days = 400x85x10x300 = 1,020,000

75 h. p., 85%, 24 hours, 300 days, = 75x85x24x300 = 460,800

1,480,800

Cost of Production.

Fuel eight pounds per h. p. hour = 5900 tons at $2.00	$11,800.00
Interest, depreciation, taxes, insurance, etc., on Boilers and Engines, 15% on $16,300.	2,445 00
Interest, depreciation, taxes, insurance, etc., on Shafting and Belting, 30% on $2,500	750 00
Oil, Waste, etc	750 00
1 Day Engineer at $75.00	900 00
1 Day Fireman at $60.00	720 00
1 Night Engineer at $60.00	720 00
Total cost of operation	$18,085 00

Steam Driven Plant With Electric Motors.

The average load in this case is only 80%.

Cost of Installation.

1 500 h. p. Boiler Equipment, complete with stack, pumps, piping, etc	$ 7,000 00
1 350 h. p. Engine	4,000 00
1 75 h. p. Engine	2,200 00
1 250 k. w., 3 phase Generator	2,800 00
1 50 k. w., 3 phase Generator	1,050 00
Cabling	750 00
1 75 h. p. Motor for Brick Machine	675 00
1 50 h. p. Motor for Pug Mill	475 00
3 35 h. p. Motor for Dry Pans	1,050 00
1 35 h. p. Motor for Cutters and Represses	350 00
1 20 h. p. Motor for Elevators	300 00
1 8 h. p. Motor for Conveyors	115 00
1 10 h. p. Motor for Disc Fan	145 00
1 50 h. p. Motor for Exhaust Fan with Variable Speed Regulator	550 00
	$21,460 00
Less extra cost for Buildings	2,500 00
Total cost of installation	$18,960 00

Horse power hours produced:

350 h. p., 80%, 10 hours, 300 days = 350x.80x10x300 = 840,000

75 h. p., 80%, 24 hours, 300 days = 75x.80x24x300 = 432,000

Cost of Production.

Fuel seven pounds coal per h. p. hour = 4450 tons at $2.00	$ 8,900 00
Interest, depreciation, taxes, insurance, etc., 15% on $18,960.00	$2,845.00
Oil, Waste, etc	500.00
1 Day Engineer at $75.00	900 00
1 Day Fireman at $60.00	720 00
1 Night Engineer at $60.00	720 00
Total Cost of Operation	$14,585 00
Cost with Mechanical Drive	$18,083 00
Cost with Electrical Drive	14,585 00
Saving with Electricity	$ 3,500 00
	= 19½%

For gas driven plants the respective costs will be somewhat less than with steam driven.

Assume the same plant as before but with gas engine, we get:

Mechanically Driven Plant.

Cost of Installation.

Producer Equipment	$11,000 00
Gas Engine	22,000 00
Belting and Shafting	2,500 00
Total	$35,500 00

Cost of Production.

Fuel, 1½ pounds of coal per h. p. = 1010 tons at $2.50	$2,525 00
Interest, Depreciation, Taxes, etc	5,500 00
Oil, Waste, etc	500 00
1 Day Engineer at $75.00	900 00
1 Helper at $40.00	480 00
1 Night Engineer at $75.00	900 00
Total	$11,005 00

Electrically Driven Plant.

Cost of Installation.

Producer Equipment	$9,000 00
Gas Engines	18,000 00
Generators	3,850 00
Cabling	750 00
Motors	3,660 00
	$35,260 00
Less Extra Cost for Building	2,500 00
Total	$32,760 00

Cost of Production.

Fuel 1½ pounds per h. p. hour=950 tons at $2.50	$2,275 00
Interest, depreciation, taxes, etc.	4,920 00
Oil, Waste, etc.	300 00
1 Day Engineer at $75.00	900 00
1 Helper at $40.00	480 00
1 Night Engineer at $75.00	900 00
Total	$9,775 00
Cost with Mechanical Drive	11,005 00
Cost with Electric Drive	9,775,00
Saving by Electricity	$ 1,230 00
	=11 per cent.

Another place where a considerable saving can be made is by adopting electricity for the hauling of the clay from the clay banks to the factory. In one case in a brick plant outside of Chicago where this system has been installed, the operating force alone for this part of the plant was reduced by about ten men.

That there is a very large field open for the introduction of electric drive in existing brick plants and the tremendous saving that thus could be accomplished is shown by the government's statistics:

Number of plants	4,634
Number of plants reporting	3,476
Number of steam engines	4,113
Total horsepower	246,200
Number of Gas Engines	220
Total horsepower	6,245
Number of Electric Motors	128
Total horsepower	3,036

Before concluding this paper it would be well to consider what one of our prominent brick machine manufacturers has to say in regard to the electric drive:

"Try to picture in your mind a brick plant free from line shafting and the necessary millwright work to support it, or the necessary brick or concrete piers. No line shaft bearings to require proper oiling. No pulleys. No couplings to work loose. No belting to fan the air, break or get loose and slip. No constant renewals and sewing of same. No danger of employees being maimed by being caught in belts, and such accidents, to be followed up by annoying and expensive law suits, and payment of lawyers' fees, court cost and damages. And when the "electric juice" is taken from a centralized plant or trolley line there will be no boilers, no engines, no engineer, no fireman, no water, no coal, no smoke, soot, ashes or dust. With the machinery properly built, setting on good foundations, driven by direct connected motors, a greater portion of the noise is removed. Then imagine a dryer drying your brick with waste heat drawn from kilns being burned with producer or natural gas, thus eliminating smoked-up brick in the dryer, no coal laying around the kilns, no men to handle the coal and ashes from the kiln, no smoke rolling from the kilns. This is not a dream, but the future brick maker's millenium, which a great many are enjoying to-day."

SOUTHERN PACIFIC RECONSTRUCTION IN ALAMEDA.

During the past week three electrical engineers from the Southern Pacific Company, Messrs. Moulthrop, Cahey and Clapp, made a trip of inspection over the local lines of the corporation to plan for the installation of the electric traction system that is to supplant the company's steam roads in Alameda. The experts were accompanied on their round of inspection by City Electrician Joseph B. Kahn, Street Superintendent V. M. Frodden and Harry Brownlee, local superintendent of the Pacific Telephone and Telegraph Company.

It was found that but few changes will be necessary in the location and position of the city's wires. The Southern Pacific Company plans to place ornamental steel trolley poles in the center of the avenues and streets through which its electric trains will run.

According to Mayor E. K. Taylor the Southern Pacific Company will put men to work on converting its local steam roads into electric lines as soon as the right of way for the connecting loop around the east end has been obtained.

SONS OF JOVE REJUVENATE IN SAN FRANCISCO.

THE Rejuvenated Sons of Jove had a very successful Rejuvenation on the evening of February 13th at the Hotel Argonaut, San Francisco, at which seven penitents with regrets for their past life, were initiated, cleansed of their sins and became members of the rejuvenated order.

These penitents who are now wiser and better men, are as follows:

Lorrin Andrews Nott, San Francisco.
Albert Casper, Vallejo, Cal.
Albert Wilkinson Vinson, San Francisco.
Lester Siebenhauer, San Francisco.
Casper Vincent Schneider, Sacramento.
Charles Lewis Turner, San Francisco.
Edwin Boaz Pike, San Francisco.

The Rejuvenation was a very interesting and dramatic one and was followed by a German supper at which forty-six members were seated. Speeches were tabooed and the amusement was furnished by the Knickerbocker Quartette, who furnished an excellent program, including the most recent popular songs.

The National organization of the Sons of Jove includes a membership of about 2,000 of which 100 are in California. Great interest is being taken in the order and the membership is increasing steadily. It is expected that another Rejuvenation will be held within the next three months, when it is hoped to add to the interest of the ceremony by the use of scenery and electrical effects.

POWER FROM COKE OVEN GAS.

While the adoption of gas engines operating on by-product coke oven gas is becoming active in this country, Japanese industries are also recognizing its advantages. The Furukawa Coke Works, Japan, recently ordered through Takata & Co. (Japanese agents for Westinghouse interests) an extension to their present gas engine plant which has been in service for some time at the coke works. The equipment ordered is a Westinghouse vertical single-acting gas engine. This order, although not of large size, illustrates the recognition of the advantages of the gas power system and illustrates dependence which the Japanese people place in American-made machinery. A similar equipment has been ordered by the Imperial Printing Office of the Japanese government, although not to operate on coke oven gas.

Engines of the same size and type have been in operation for several years in the United States at the works of the Semet-Solvay Co., Syracuse, N. Y., and at the Otto Coke Works, Camden, N. J. The most important application of by-product coke oven gas has occurred at Lebanon, Pa., where there are now located two plants aggregating several thousand horsepower. Both of these employ the Westinghouse horizontal double-acting type gas engine, solid couplet to alternating current generators for power, light and traction service. All of the equipments are of standard Westinghouse construction, and one of these plants which has been operating for over a year, has thoroughly proven its adaptability, without requiring special design. This plant regularly operates on run-of-oven gas ranging from 50 to 65 per cent hydrogen and one to two grains sulphur per cubic foot. This plant is located at the Lebanon works of the American Iron and Steel Manufacturing Co. The second plant under construction is located near Lebanon, at the works of the Cornwall Ore Banks, otherwise known as the Pennsylvania Steel Co., adjacent to the extensive plant of the Semet-Solway Co. Further important developments in this line are anticipated in the near future.

The electrification of the Melbourne tramways has been deferred by the Victorian Railway Commissioners after careful consideration of a report made by Mr. Charles Merz.

CURRENT COMMENT

Tantalum lamps, 220 volts, are now on the market.

Thomas A. Edison celebrated his 63rd birthday on February 11, 1909.

Electric transmission of photographs by the Korn apparatus is in commercial use between Paris and Berlin and London.

Electric power for the Alaska Treadwell mines is to be supplied by a $750,000 hydro-electric plant to be built on the Taku run, thirty miles from Juneau, Alaska.

Electrification of the Salt Lake and Ogden Railway is to be accomplished by equipping the present steam road with over-head trolley and high-speed interurban cars.

A bursting fly wheel wrecked one of the buildings at the Anaconda smelter in Montana last week. Fragments of iron were hurled through the roof of the building but no one was hurt.

Electric snow melters are being used to clear the streets of Berlin, Germany. With an experimental apparatus the cost proved to be less than half that of shoveling and carting it away.

Weather reports by wireless telegraph are furnished the British Meteorolgical Offices by ships in the Atlantic. The ocean has been divided into numbered areas so as to locate all reports.

California's oil production for 1908 is estimated at from 44,000,000 to 46,000,000 barrels of crude petroleum, exceeding that of 1907 by about twelve per cent, when California was second in rank among oil producing states.

Water for copper smelting at Ely, Nevada, is brought to the Steptoe Valley plant, from Duck Creek by a 32-inch pipe line, 48,000 feet long, delivering 1,200 cubic feet per minute. A 250 h. p. electric generator is to be operated by waste water from the pipe line.

Electrification of Japanese railroads is recommended in an exhaustive report submitted by the Imperial Engineer Corps, Tokio being the first center of attack. Japan has large water powers that will readily lend themselves to hydro-electric power developers.

The largest storage battery in the world is to be installed at the Sixteenth Street substation of the New York Edison Company by the Electric Storage Battery Company. It will have 150 cells with a capacity of 22,000 amperes for one hour at 120 volts. It is to be used for emergency needs.

A British Radium Institute is to be established by the King of England to apply radium in research and medical work. Austria has forbidden the export of radium from Bohemia, Europe's chief source, and a company has been formed to manufacture it from pitchblende found in the mines of Cornwall.

Examination for mechanical and electrical engineer will be held by the United States Civil Service Commission on March 17-18, 1909, to fill a vacancy in the position of mechanical and electrical engineer, $1,200 per annum, Quartermaster's Department at Large, Fort Bayard, New Mexico, and vacancies requiring similar qualifications as they may occur in any branch of the service. The examination will consist of mathematics and practical calculations (comprising arithmetic, algebra to and including problems involving quadratics, geometry, mensuration, logarithms and use of tables, elementary problems in mechanics, use of slide rule, interpretation of formulas and the correct working out of results for special cases); drawing, involving a competent knowledge of machine construction and ability to draw neatly to scale; materials, comprising all the materials employed in machine construction; theory and practice of electrical engineering, comprising theory, nomenclature, practical computations, and construction and operation of simple machines and apparatus (competitor will be given a choice of questions in this subject); training and experience (rated on application). Applicants who fail to indicate in their applications that they have had at least five years' practical experience in mechanical and electrical engineering will not be admitted to this examination. Graduation in mechanical or electrical engineering will be considered as equivalent to not less than three years of this period.

American Society of Hungarian Engineers and Architects has been organized by a number of Hungarian engineers and architects pursuing their professions in this country. The society has two objects: First—to bring in closer touch engineers and architects of Hungarian extraction, living in this country, and to give moral support and information to newcomers. Second—to encourage the exchange of engineering, technical and industrial information between the technical men of Hungary and of the United States and to foster technical societies, sciences and industries. The society will hold monthly meetings where papers will be read and discussed. The membership consists of mechanical, electrical and civil engineers, chemists, architects and draftsmen. Following are the officers of the new society: President, A. Henry Pikler, M. E., engineer in charge of transformer department of Crocker-Wheeler Company, Ampere, N. J.; Vice-President, Karoly Z. Horvay, architect, chief draftsman, Building Bureau of Board of Education, Brooklyn, N. Y.; Secretary, Zoltan de Nemeth, M. E., New York Edison Company; Treasurer, Sandor Oesterreicher, E. E., New York Edison Company; Assistant Secretary, Ernest L. Mandel,, B. S. C. E., Bureau of Commissioner of Public Works, New York City. The society's business address is Box No. 103, New York City.

A telegraph between England and India has been completed, making direct communication between London and Calcutta. According to the Electrical Review, the Indo-European Telegraph Company's line from London passes to Lowestoft, then by submarine cable to Germany, through Emden and Berlin to Russia, through Warsaw, Rowno, and Odessa to Kertch, where the company has three submarine cables across the straits; thence it passes through Tiflis and Tabriz to Teheran, the capital of Persia, which, until January 20th, 1909, was the terminus of the Indo Company's circuit. In December, 1902, the construction of a new line from Teheran to Kurrachee was taken in hand, and has been completed, making the terminus of the Indo Company's line on Indian territory. The new line increases the total length of circuit from 3,800 miles to 5,374 miles. This extension of 1,574 miles has entailed the provision of three additional repeater stations, one at Teheran, another at Kerman, and the third at Panjur in Beluchistan. All messages between England and India passing over this route will be received direct without re-transmission, there being now thirteen automatic repeaters in the circuit. As an illustration of what could be done when required, various line extensions were added to the circuit by other automatic repeaters, and direct communication was thus obtained at a speed of about 40 words per minute with Madras, and later with Calcutta and Rangoon, a distance of 7,700 miles, the record.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

FOUNDED 1887 AS THE
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CONTENTS

The Largest Windmill in the United States 131
A description of the new Dutch windmill in Golden Gate Park, San Francisco.

Prime Movers ..... *By Chas. P. Steinmetz* 132

Standard Specifications for Coal 135

Regulation of Gas Service ..... *By William B. Jackson* 135
Rules for the regulation of gas supply for Chicago.

Natural Gas in India 137

San Francisco Department of Electricity 137

The Economy of Electric Drive as Applied to Brick and Tile Production ..... *By E. A. Lof* 138
A comprehensive paper giving valuable cost data.

Southern Pacific Reconstruction in Alameda 140

Rejuvenation of San Francisco Sons of Jove 140

Power From Coke Oven Gas 140

Current Comment 141
Tantalum Lamps, 220 volts.
Thomas A. Edison's Birthday.
Electric Transmission of Photographs.
Electric Power for Alaska Treadwell Mines.
Electrification of Salt Lake & Ogden Railway.
Bursting Flywheel at Anaconda Smelter.
Electric Snow Melters.
Wireless Telegraph Weather Reports.
California's Oil Production.
Water for Copper Smelting at Ely.
Electrification of Japanese Railroads.
Largest Storage Battery in the World.
British Radium Institute.
Examination for Mechanical and Electrical Engineer.
American Society of Hungarian Engineers and Architects.
Telegraph Between England and India.

Editorial 142
Electrical Casualties.

Personals 143

Program of Electrical Vehicle Convention 143

Westinghouse Patent Litigation 143

Trade Catalogues and Notes 143

Los Angeles Section A. I. E. E. 143

San Francisco Section A. I. E. E. 143

Patents 144

Industrial 145
New Line of Alternating Current Self-starters.
Westinghouse-Le Blanc Condenser.
New Duncan Meters.
New Idea in Desk Lamps.
New Dale Cluster.
Turbine Experience.
Compulsory Wireless Telegraph.

Approved Electrical Devices 148

News Notes 149

Electrical Casualties

When we handle electricity carelessly we run the risk of fire or death. Before such an event happens it is usually called a hazard, afterwards, an accident. This trait of courting the possibility of loss or harm for the possibility of benefit is even older than the derivation of the word hazard. Four thousand years ago the ancient Persians "played craps" with "el zar." In the seventh century of the present era the Arabs forced their language and customs on the people of Spain and the Spaniards thus call any unexpected happening "azar," which the French have converted into "hazard." Like the game from which it derives its name, in a hazard the possibilities of gain or loss are nearly equal.

This is hardly true of electrical construction, for the advantages of electricity are far greater than any possible damage which may result from its use, especially when such damage may be avoided by proper precautions. In so much as the results of this carelessness in the handling of electricity at high potential can be anticipated, any disastrous consequences should be called a causuality rather than an accident, which is incalculable.

But enough of this pedantic quibbling over words. This matter is a serious question requiring public attention. The insurance companies, through the Underwriters' National Electric Association, have prescribed rules and regulations minimizing fire from electrical causes. These rules are enforced by exacting the penalty of higher insurance rate. Such mildness unfortunately does not characterize the penalty for violation of the rule not to come in contact with current carrying devices.

Analyzing a discussion of this question which has recently appeared in "Electrocraft," we find three factors that contribute to the life hazard of electricity. First, there are certain dangerous fixtures, which are under the ban of the Code, and are fast being eliminated. Second, there is the matter of the proper grounding of transformer secondaries and exposed conductors. Lastly, there is the voltage limit allowable in places ordinarily reached by the public. While this is an economic question in the distribution of power and light, it is one that should be investigated.

With regard to the responsibility for the safeguarding of the public, "what is everybody's business seems to be no one's business." In shifting this burden the secretary of the Underwriters' National Electrical Association makes the apt comparison of an automobile, whose gasoline is subject to regulation on account of the fire insurance, but whose speed limit is purely a life hazard, and therefore beyond his domain. Reasonable requirements can be enforced by state or municipal authorities, and it is probably to them that we must look for relief.

PERSONALS.

G. B. Rice has been appointed chief draftsman for the Pacific Electric Railway at Los Angeles, Cal.

T. E. Bibbins, of the General Electric Company, left on Tuesday for a trip of a week or ten days to Sacramento and Salt Lake City.

Emerson W. Read announces the removal of his law offices to the Thomas Clunie Building, California and Montgomery streets, San Francisco.

Mr. D. D. Schindler, 439 Thirty-seventh street, Oakland, Cal., has been appointed representative of the Anderson Porcelain Company of East Liverpool, Ohio, for San Francisco and vicinity.

C. F. Brady, formerly purchasing agent of the Pacific Electric Railway Company at Los Angeles, now represents a number of well-known Eastern manufacturers in Los Angeles with an office at 641 Pacific Electric Building.

C. W. Scott, manager of the San Francisco office of the H. W. Johns-Manville Company, has returned from an Eastern trip during which he visited several of their Eastern houses, and attended the conference of managers which was held in New York.

E. K. Patton, western manager with headquarters at Chicago, for the Bryant Electric Company, and the Perkins Electric Switch Manufacturing Company, of Bridgeport, Conn., will reach San Francisco on his annual Pacific Coast trip on February 20th.

PROGRAMME ELECTRIC VEHICLE CONVENTION,
St. Francis Hotel, San Francisco,

FRIDAY, FEBRUARY 19TH.

10:30 A. M.—Welcome to Delegates and Opening Address.
R. B. DAGGETT,
Manager San Francisco Office Electric Storage Battery Company.

11:00 A. M.—"The Mercury Arc Rectifier."
R. M. ALVORD,
General Electric Company, San Francisco.

1:00 P. M.—"Vehicle Batteries."
GEORGE R. MURPHY,
Engineer Electric Storage Battery Company.

3:30 P. M.—"Relation of Central Station Companies to the Automobile Business."
MR. FRED T. KITT,
Sacramento.

5:00 P. M.—"The Electric Vehicle Motor."
J. T. DEREMER,
Westinghouse Electric and Manufacturing Company, San Francisco.

SATURDAY, FEBRUARY 20TH.

9:00 A. M.—"The Commercial Electric Vehicle."
A. C. DOWNING,
Manager Electric Automobile Department, Studebaker Brothers Company, Pacific Coast.

10:30 A. M.—"Electric Pleasure Vehicles."
F. W. PFAFFMANN,
Los, Angeles,
Representing Rauch & Lang of Cleveland.

11:30 A. M.—"The Electric Garage."
S. P. REED,
Reed Electric Laboratory, San Jose, Cal.

Discussions will follow all papers and a general discussion will follow the presentation of the last paper on Saturday.

SAN FRANCISCO SECTION A. I. E. E.

A meeting of the San Francisco Section of the American Institute of Electrical Engineers will be held on Friday, February 26, 1909, at 8 p. m. Mr. S. B. McLenagan, general manager of the Central California Traction Company, of Stockton, will read a paper descriptive of their new 1,200 volt direct current road, the only one in the world employing such a high line voltage.

WESTINGHOUSE PATENT LITIGATION.

The Westinghouse Electric and Manufacturing Company recently brought suit against the Bullock Electric Manufacturing Company for infringment of the Tesla polyphase system and of the Nolan Spring Ring Armature. With regard to the former Judge Thomson of the United States Circuit Court for the Southern District of Ohio, has decided that infringement exists, but with regard to the latter has decided that there is no proof of infringement.

In the Edgewise Circuit-Breaker case brought by the Westinghouse Electric and Manufacturing Company against the Condit Electrical Manufacturing Company, the United States Circuit Court of Appeals upholds the validity of the Wright and Aalborg improvement in automatic circuit breakers and sustains the claim of infringement.

LOS ANGELES SECTION A. I. E. E.

Los Angeles Section of the American Institute of Electrical Engineers met at the University of Southern California on Tuesday, February 16, 1909, at 8 p. m. A paper on "Limitations in Hydro-Electric Transmission," was read by R. J. C. Wood.

TRADE NOTES.

The Marshall Electric Company, manufacturers of the well known Marshall line of Sockets, Switches, Pipe Ends and other specialties have moved from their former location in Boston to Hyde Park, Mass., where they will occupy a new and modern factory building constructed especially for them.

The Standard Electrical Construction Company have closed a contract for the electrical work in the new Thompson Cafe, which will be opened between the first and fifteenth of the coming April, in the basement of the Flood Building, which was occupied by Tait's restaurant prior to the San Francisco fire.

B. C. Van Emon, of the Van Emon Elevator Company, who has just returned from a trip through the Northwest, advises that while he was in Vancouver, B. C., he was successful in closing a contract with the Dominion Trust Company for the entire electrical elevator equipment in the new Imperial Hotel there. The amount of the contract is in the neighborhood of $25,000. He also closed, while in Vancouver, a contract for one passenger and two freight elevators in a business block now under construction there.

TRADE CATALOGUES.

Instruction Pamphlet No. T5042, from the Westinghouse Traction Brake Co., shows the construction and gives directions for regulation and adjustment and installation and maintenance of electric pump governors for the automatic control of motor-driven air compressors.

The new bulletin on Alternating Current Switch Boards recently issued by the F. Bissell Company, of Toledo, Ohio, is devoted to single, two and three phase demands in generator, feeder and totalizing panels, as well as D. C. Exciter Panels. This, together with information covering instruments, switchboard parts and appliances, as well as line drawings of all standard boards and photographs of notable installations makes it of value to the electrical trade.

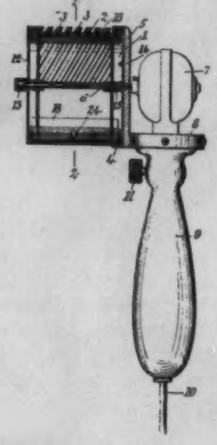
The Garvin Machine Company, Spring and Varick streets, New York City, are distributing their edition "D" catalogue. This catalogue is printed in English, German and French, and illustrates and describes their line of Profiling Machines, both Wesson and belt-driven, No. 14 and No. 15 Vertical Spindle milling machines, No. 2 Lincoln milling machine; five sizes of Duplex milling machines; No. 3 Universal cutter and tool grinder; tapping machines, including horizontal, vertical and automatic; gang drill presses and duplex drill lathes.

PATENTS

911,439. Contact Plug for Electric Irons, Heating Appliances, and the Like. Richard G. Pheysey, Ontario, Cal. In combination, an insulating plug having recesses and holes formed therein and also slots leading from said recesses, two spring clips each formed of two members of sheet metal

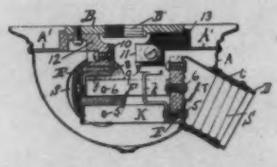
secured together so as to inclose one end of the lead wires, said clips being secured within the holes formed in the plug and extending into the recesses therein, and two tongues or binding posts secured to the terminals of an iron and adapted to project into the plug and between the spring members of each of the clips, as specified.

911,472. Electric Safety Razor. Luigi Brunacci, New York, N. Y. A safety razor having a handle, a bracket attached to the end of said handle and having an offset upwardly projecting head, an electric motor seated on said bracket and



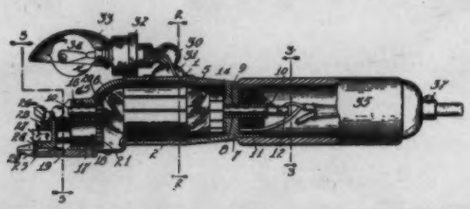
having a shaft extending through said head, a substantially cylindrical guard attached to the outer side of said head, and a rotary blade holder attached to said shaft within said guard.

911,475. Multiple Lamp Socket. Leger J. Castonguay, Bridgeport, Conn., assignor to The Bryant Electric Company, Bridgeport, Conn. A multiple socket cluster having a series



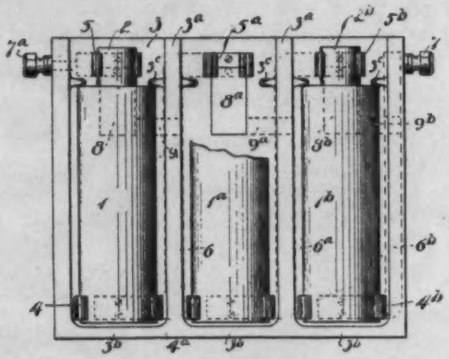
of socket units, each unit with its axis inclined but with its insulating base piece parallel to the axis of the cluster for the purpose described.

911,139. Electrically-Actuated Hair and Wool Clipper. Hugo Luense, Chicago, Ill. In a device of the character described, the combination of upper and lower motor pole plates, cores extending between said pole plates at each end thereof, field windings surrounding said cores and openly exposed as to their outer sides, an armature interposed between said windings and pole plates, a hollow frame member rigidly secured to the rear edges of the pole plates, an armature shaft journal opening in said frame member receiving the shaft of said armature, commutator brushes yieldingly mounted to extend longitudinally within said frame member and bearing yieldingly against the commutator of the armature, a tubular handle rigidly connected with the rear end of



said frame member, a second hollow frame member rigidly connected with the front edges of said pole plates, an armature shaft journal opening in the latter frame member, a counter shaft bearing formed to extend through the front end of the latter frame member, intermeshing gears upon the armature shaft and counter shaft, respectively, a fixed shear blade rigid with said second hollow frame member, a reciprocatory shear blade movably mounted upon said fixed blade, and driving connections between the counter shaft and movable blade.

911,522. Electric Battery Holder and Battery. George L. Patterson, New York, N. Y. In apparatus of the character described, a holder, devices carried thereby arranged to make electrical and mechanical connection with a plurality of batteries, said devices including two sets of terminals, both



terminals of one set being electrically connected with one of the terminals of a second set when no battery is in engagement with the first-mentioned set, and a circuit closer in the first-mentioned set adapted to be operated by a lateral movement of the battery when the latter is inserted in or removed from the holder.

911,055. Mounting for Fuses. John J. Lyng, New York, N. Y., assignor to Western Electric Company, Chicago, Ill.

A fuse-mounting comprising a tube of refractory insulating material, a metal cap molded upon the end of said tube, said head having a screw embedded therein, with the shank of said screw projecting through said head to receive a binding nut, in combination with a fuse wire contained within said tube and having its end embedded in the material of said molded head and thus electrically connected to said screw.

INDUSTRIAL

A NEW LINE OF ALTERNATING CURRENT SELF-STARTERS.

A new line of self-starters designed for use with alternating current motors has recently been placed on the market by The Cutler-Hammer Manufacturing Company, of Milwaukee. These include self-starters for use with single, two or three phase motors which may be thrown directly across the line to start two types of self-starters for squirrel cage motors and two for slip ring motors. In addition to these five types of self-starters the same company has brought out a line of two-pole and three-pole float switches.

The float switch is used in connection with a copper float, chain and weight for automatically starting and stopping motors, operating pumps on open tank systems. By adjusting two buttons on the chain passing through an eye in the arm of the float switch, this arm will be moved up or down whenever the

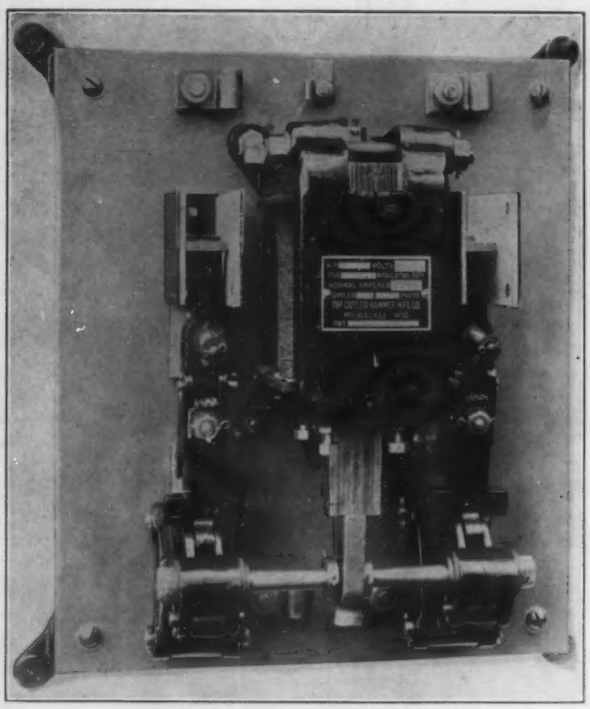


Fig. 1. Cutler-Hammer Self-Starter for 2 or 3 Phase Motors.

water in the tank reaches a predetermined high or low level, thus opening or closing the circuit to the solenoid of the self-starter which in turn operates to stop or start the motor.

The self starter, illustrated in Fig. 1, standard in sizes from 1 to 15 h. p., but can be used only with single, two or three phase motors which can be thrown directly across the line to start. It can be used in connection with a float switch and copper float on open tank systems and by substituting a pressure regulator for the float switch it can also be employed for automatically starting and stopping motors operating on compression systems.

It finds a further application in the vacuum air cleaning systems which are now being so widely installed in hotels, apartment houses and office buildings. In such cases, the motor, self starter and vacuum pump are usually installed in the basement and a snap switch or push button for starting and stopping the motor is placed on each floor, or in each room, if desired, these being connected to the solenoid of the self-starter by small pilot wires, the heavy wiring being again reduced to a minimum as in the case of self-starters used in connection with pumps.

The self-starter shown in Fig. 2 reduces the starting current by inserting resistance in the primary circuit of the motor. Where it is desirable to still further reduce the starting current, a potential type of self-starter should be used. Squirrel cage motors are not well adapted for starting under heavy loads, hence the self-starters above described should be used only where the starting duty is light. They are well adapted for starting line shafts, ventilating fans or centrifugal pumps, but are not suitable for use with reciprocating pumps or machinery starting under load.

As stated above, the self-starter illustrated in Fig. 1, can be used only in connection with alternating current motors which can be thrown directly across the line to start. The leading power stations of the country limit the size of the squirrel cage motors which they will permit to be thrown directly across the line to 5 to 7½ h. p. If larger motors are installed it is necessary to reduce the starting current taken by the motor so as to avoid causing violent line disturbances. In such cases the self-starter illustrated in Fig. 2 should be used.

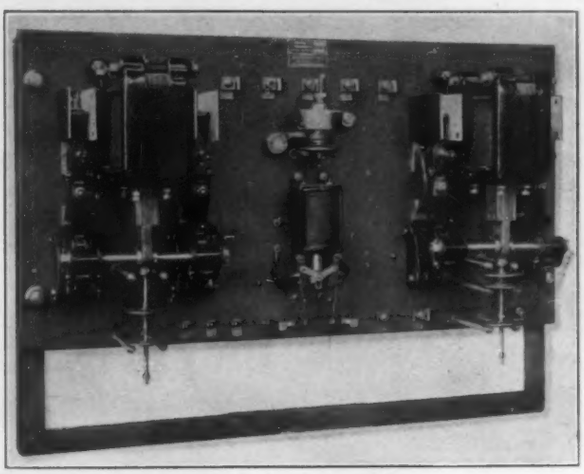


Fig. 2. Cutler-Hammer Self-Starter for Squirrel-Cage Motors.

The slip ring type of motor is much better suited for heavy starting duty than the squirrel cage motor, its starting characteristics being similar to that of a direct current shunt wound motor in cases where the starting torque does not exceed 250 per cent of the normal torque. In other words, a line current of 150 per cent gives a starting torque of 150 per cent which is usually sufficient to start an average load. Where it is desirable, therefore, to reduce the starting current taken by the motor to the lowest possible amount a slip ring type of motor should be used.

THE WESTINGHOUSE-LEBLANC CONDENSER.

The American adaptation of the type of condenser which has been so favorably received in Europe, is meeting with success in this country. A number of contracts have been closed during the summer for equipments, most of which are in connection with new turbine equipment.

The Narragansett Electric Light Company, Providence, R. I., is installing two units, 7000 h. p., in connection with new turbine equipment.

The B. F. Goodrich Rubber Company, Akron, Ohio, have ordered one unit in connection with a new turbine for their central power plant. This company was among the pioneers in the use of the Westinghouse turbine, and heretofore most of their experience has been with the surface type condenser.

The Coronet Phosphate Company, Plant City, Fla., have

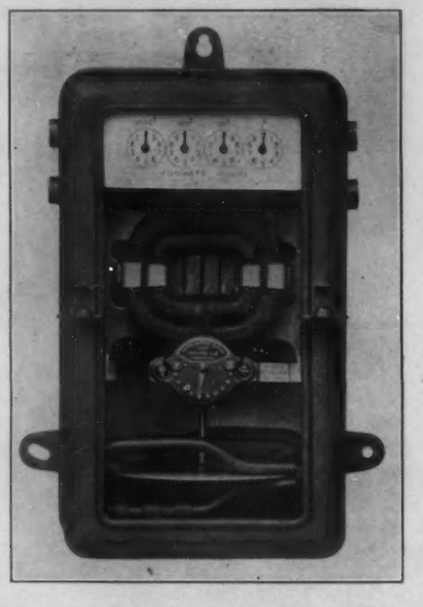
ordered three units for use also in connection with turbines, and the Portland Cement Company, Trinidad, Colo., one unit. Likewise the City of Logansport, Ind., and the Bristol, Tenn., Gas and Electric Company.

Other equipments are being built for the Jersey Central Traction Company, the Washington and Mt. Vernon Railway, in connection with their new turbine plant, and the Cleveland Electric Company, which equipment is about to go in service.

The Westinghouse-Leblanc condenser possesses many advantages in the way of compactness, and particularly in the ability to maintain high vacuum with limited supply of cooling water. Upon repeated tests it has been able to operate within from one to five degrees difference between the temperature corresponding to the exhaust steam and that of the cooling water discharge. This represents an efficiency of the condenser of 96 to 99%. These results are obtained by an unusually efficient method of handling the entrained air and are particularly effective in cases of high cooling water temperature, 80 to 85 degrees. They also greatly favor the employment of cooling towers in connection with the condensing plant, reducing the quantity of water to be pumped and increasing the effectiveness of the cooling tower surface by delivering water to the tower at the highest possible temperature.

NEW DUNCAN METERS.

A new Duncan Direct Current Integrating Wattmeter, house type, model E, is now being put on the market by the Duncan Electric Manufacturing Company. The accompanying illustration, from which it will be seen that its design is very much up to date and in strict accordance with modern requirements.



Duncan Direct Current Integrating Wattmeter.

The back portion, as well as the lower shelf or magnet support, are made from sheet brass formed up into shape under enormous pressure, so that they present a degree of strength and rigidity that surpasses the castings used on the older forms, besides reducing the total weight of the meter. Mounted upon the lower magnet support or shelf is a well proportioned arch which is also pressed up from sheet brass, and to which are attached the series field coils, compensating coil, upper bearing, brushes and compensating switch, thereby enabling all of the principal elements to be combined on one support.

The new binding posts are so constructed and fastened into the back of the meter that they are not only dust proof but absolutely fire proof. The registering train has four circles of large dimension, so that they can be read with much ease at a considerable distance. The gear wheels and pinions are cut by automatic machinery, which renders the possiblity of their binding or sticking very remote.

The multipoint switch method of compensating for friction and vibration is maintained throughout the entire line of these instruments, and no change has been made in it by virtue of its giving such universal satisfaction, and which all meter experts pronounce as being the most reliable that has yet been used. To secure any degree of compensation simply involves the movements of the compensating switch lever over one or more contacts, and when the proper amount has been obtained, it is impossible to bring about any change through rough handling, as is usually the case where such compensation is secured through bodily adjustment of the compensating coil.

The cover is dust, moisture and insect proof and is held in position in a new and novel manner by the use of wing headed screws which are so fastened upon the inside that it is impossible for them to drop out and become lost when the cover is turned upside down. This feature will be appreciated by linemen who have always objected to the old method of fastening the covers, by having to come down off the ladder to look for a screw or wing nut which they dropped.

The method of sealing is also new, and is an absolute guarantee against tampering by unauthorized individuals.

The accuracy of this new instrument surpasses anything now on the market, and is due to its very high turning moment, the smallest size having a torque of not less than 200 millimeter grams, or nearly 25% greater than any other now in use. The larger meters have, of course, a greater torque and in some of these sizes it is as high as 600 millimeter grams.

The quality of the steel employed to make the permanent magnets is the same as has been used by this company for years, and is known as the "Remy brand." It is a special steel of exceptionally high retentivity and permanence and is recognized as being superior to all others for these two qualifications. In order to make these magnets as permanent as possible, they are put through a process of artificial aging which enables them to maintain a uniform strength for an indefinite period, so that the accuracy of the meter is never changed unless through some other cause, such as the accidental breaking of a sapphire jewel or the like.

For the 110 volt sizes, the resistance unit is of the cartridge type. It is 4 inches long and 1 inch in diameter, and is slipped into the meter in the same manner as you would a cartridge fuse into a fuse block, which renders its removal or insertion a matter of a few seconds and is a wonderful improvement over other methods and forms still employed. This resistance unit is imbedded within a fire proof composition, so that the matter of being troubled with burned out resistances is at an end as far as the new Duncan Meter is concerned.

The other patented features which have made the Duncan product so popular are still retained, such as the visual bearing, which permits the insertion and removal of the detachable spindle point also examining and oiling of the bearing; the threadless jewel post which has put an end to the threaded type that causes so much trouble by binding in the threads.

The old form of armature is also maintained, by virtue of its having proved itself to be much better than any that has yet been tried. It is very easy to repair; it is mounted upon a light framework; and is wound with 8000 turns of No. 40 B. & S. gauge electrolytic copper wire insulated with Italian Tram Silk.

The brushes are of the direct tension type which have demonstrated for themselves that it is the only safe and practical way to avoid sparking, particularly when the meter is installed in places where there is vibration.

To facilitate the work of testing, each meter is now marked with the exact number of watts that is required to make one revolution per minute, so that anyone undertaking to test the meter will know the watts required without having to figure it out from a constant.

The Duncan Company has also put upon the market a full

line of astatic switchboard meters. The series field coils are so arranged that they oppose each other, and within them is placed a four pole armature with the brushes set upon the commutator at an angle of 90°.

The tests which have been going on for some time have proven, beyond the possibility of a doubt, that this type overcomes to a great degree the influence of external fields. By bringing bus bars as close to the meter as its mechanism will permit the errors introduced thereby are scarcely perceptible and do not exceed 2%.

This new idea of the Duncan Company as applied to their meters is also being carried out in the larger sizes of their house type meters, inasmuch as there has been a complaint for years, from central stations regarding the detrimental influence which nearby conductors have on their accuracy.

A NEW IDEA IN DESK LAMPS.

Proper illumination of desks is a problem which has never been satisfactorily solved. Most of the lamps used for this purpose today consist of an ordinary incandescent bulb lamp placed in a small reflector, which throws nearly all of the light on one section of the desk and leaves the balance of the desk insuffiiciently lighted.

Fig. 1.

The nearest thing to perfection in this line is a new line of desk lamps recently placed on the market by the H. W. Johns-Manville Company, New York, known as "Linolite" Desk Lamps. Several of these are shown by illustrations herewith.

While the design of these lamps is somewhat different from others now on the market, their novel feature is in the lamp. Instead of the ordinary bulb lamp generally used, the tubular Linolite lamp, here shown, is employed.

Fig. 2.

This tubular Linolite lamp is 12 inches long between centers and, therefore, distributes the light more evenly and over a larger area of the desk than bulb lamps. Its filament is stretched out straight from end to end and lies throughout within the focus of the reflector. As the filament of a lamp throws its greatest light at right angles to its axis, this Linolite lamp naturally gives more useful light than bulb lamps, whose filament cannot lie in the focus of a reflector on account of being coiled. These lamps are made in burnished (old) brass finish, oxidized copper finish and gun metal finish, and present a very handsome appearance.

NEW DALE CLUSTER AND SHADE HOLDER.

Illustrated herewith is a new cluster and shade holder made by the Dale Company. It embodies several ingenious ideas, being made in two parts, the detachable base and the cluster body. A simple pull detaches and a push securely locks it; no twisting or turning, no chance for the cluster to unscrew from stem. All parts are completely insulated with the best quality porcelain; no fibre insulation used. Cluster can be used for either inside or outside work.

The body or shade may be readily removed without disturbing any wire connections. This cluster is made for from 2 to 7 lights.

One of the distinct advantages of the Dale new cluster is the fact that the detachable bases may be wired up and when the mechanics are out of the building the cluster body, shades, etc., may then be installed.

DALE DETACHABLE CLUSTER

TURBINE EXPERIENCE.

A 300 k. w. Westinghouse turbine unit has been in operation at the Burlington Municipal Electric Light plant, Burlington, Vt., since 1906. A recent report from this plant states officially that the total expense for repairs up to the present time, has been $1.83. Since its installation, this turbine has run nearly every night, and, it is stated, "has proven very economical in the consumption of steam, and the uniformity of speed is remarkably good. In fact, we do not know how it could be more satisfactory."

The first electric railway in Warsaw, Russia, was put in service in April, 1908, and will be managed by a syndicate which has a contract with the city until 1922. The company operates 304 cars and charges 3.6 cents for first-class passengers and 2.5 for second-class. The daily hours of labor for employees are from 7 a. m. to 11:30 p. m., for which motormen receive 62 cents to 67 cents and conductors are paid 62 cents to 83 cents.

SAN FRANCISCO, CAL.—The specifications for the 43,000 tons of cast iron pipe needed for the auxilliary fire protection system in this city were formally approved last week by the Board of Public Works, and bids called to be opened March 10 on the $1,200,000 job.

Compulsory wireless telegraph equipment on ocean going vessels as recommended by President Roosevelt in a recent message to Congress is provided in a bill just passed by the House of Representatives.

APPROVED ELECTRICAL DEVICES

ATTACHMENT PLUG, FUSELESS.

"G. E." Separable Cap types. 6 A. 125 V., 3 A. 250 V. Porcelain. Cat. No. 42456. Composition Edison type, Cat. No. 58729, 58730. Cord Connector type, Cat. No. 59071. Approved Jan. 20, 1909. Manufactured by

General Electric Co., Schenectady, N. Y.

CABINETS.

"Lang" Standard Metal Panelboard Cabinets and Sheet Steel Entrance Boxes. Approved Dec. 28, 1908. Manufactured by

Lang Electric Co., 116 N. Lincoln St., Chicago, Ill.

CONDUIT BOXES, FLOOR OUTLET.

"G. E.," "P. R.," "Adjustable" and "Adjustable self-leveling" types water-tight floor outlet boxes. Cat. Nos. 76470, 76459, 76460, 75940. Approved Jan. 18, 1909. Manufactured by

General Electric Co., Schenectady, N. Y.

CONDUIT OUTLET PLATES.

"Fancleve" cast iron outlet plates. Cat. Nos. 601 to 605 inclusive for knob and tube work. Cat. Nos. 700 and 701 for armored cable. Cat. Nos. 171 to 175 and 161 to 165 inclusive for use with canopies of fixtures where supply wires are in wooden moulding. Cat. Nos. 561 to 565 inclusive for use with rigid conduit. Approved Jan. 18, 1909. Manufactured by

J. L. Gleason, Jamaica Plain, Mass.

GROUND CLAMPS.

"Perma-Effect." A single strip of hard drawn copper, having the ends secured by a single bolt and provided with lug for soldered connection to ground wire. Size for ⅜ to 3 inch pipe. Approved Jan. 23, 1909. Manufactured by

H. T. Paiste Co., 32d and Arch Sts., Philadelphia, Pa.

HEATERS.

"Pacific" Pressing Irons. Domestic patterns 3 to 12 lbs., for circuits of not over 250 volts. Irons equipped with approved plugs and cord. These irons have very heavy cast iron and pressed steel extensions at back, serving as stands when device is not in use. It should be noted that as yet no adequate means have been brought forward for eliminating certain hazards incident to the use of electric pressing irons and records show that such devices left with the current "on" are causing comparatively frequent losses. The general design and workmanship shown in the construction of these Pacific irons and accompanying stands were approved Dec. 28, 1908. Manufactured by

Pacific Electric Heating Co., Ontario, Cal.

RECEPTACLES, MINIATURE.

"G. E." Miniature and Candelabra porcelain base receptacles, ½ A., 125 V. Cat. No. 9445, Miniature, cleat type. Cat. No. 9446, Candelebra, cleat type. Cat. No. 60103, Candelebra Sign receptacle. Approved Jan. 18, 1909. Manufactured by

General Electric Co., Schenectady, N. Y.

RECEPTACLES, STANDARD.

"Hubbell" Wall Sockets, pull type, 50 C. P. 250 volts, Cat. Nos. 35006, 35028, and angle base 35021. Also ceiling socket Cat. No. 35032. Approved Dec. 28, 1908. Manufactured by

Harvey Hubbell, Inc., 35-37 Organ St., Bridgeport, Conn.

RECEPTACLES, STANDARD.

"Tregoning" receptacles, 3 amp., 250 volts. Cleat type. Cat. No. 303, Sign. Cat. Nos. 300, 301 and 302. Approved Jan. 4, 1909. Manufactured by

Tregoning Electric Mfg. Co., 224 High St., Cleveland, Ohio.

ROSETTES, FUSELESS.

"C. E. M. Co." concealed type single piece rosette, 3 amp., 250 volts. Approved Dec. 28, 1908. Manufactured by

Conn. Electric Mfg. Co., Riverside Ave., Bantam, Conn.

SIGN-MACHINES.

"Carbon-Break" type, 15, 30, 45 and 60 amp. per switch for 110-220 and 220-440 volts circuits. "Series-Carbon" type, 500 to 200 amperes for 600 volt grounded circuits. Approved Jan. 30, 1909. Manufactured by

Reynolds Dull Flasher Co., 152 Fifth Ave., New York City, N. Y.

SIGN-MACHINES.

"Chaser," "Script" or "Lightning" type. Current rating 2 amperes per circuit; for 125 volts only. "Flag" type, current rating, 3 amperes per circuit, for 125-250 volts. Approved Jan. 29, 1909. Manufactured by

Reynolds Dull Flasher Co., 152 Fifth Ave., New York City, N. Y.

SOCKETS, STANDARD.

Brass shell sockets, key 50 c. p., 250 v., keyless 3 a., 250 v. Cat. Nos. 60504-7 and 60510-11 with mica disks under Edison screw shell. Approved Jan. 30, 1909. Manufactured by

Marshall Electric Co., Boston, Mass.

SOCKETS, WEATHERPROOF.

C. E. M. Co., all porcelain pendant type, 3 a., 250 v. Cat. No. 9366. Approved Jan. 15, 1909. Manufactured by

Connecticut Electric Mfg. Co., Bantam, Conn.

SWITCHES, SURFACE SNAP.

"G. E." with or without indicator, closed or slotted bases. Single pole, 3 a., 250 v.; 5 a., 125 v.; Cat. Nos. 59873-74, 60294-95. Single pole, 5 a., 250 v.; 10 a., 125 v.; Cat. Nos. 60447-50. Double pole, 5 a., 250 v.; 10 a., 250 v.; Cat. Nos. 60950-53. Three-way, 1 a., 250 v.; Cat. Nos. 60451-54, 60296. Three-way, 3 a., 250 v.; 10 a., 125 v.; Cat. No. 60955. Three-way, 5 a., 250 v.; 10 a., 125 v.; Cat. Nos. 60455-56. Four-way, 2 a., 250 v.; 5 a., 125 v.; Cat. Nos. 60458-59. Two-circuit, 2 a., 250 v.; 5 a., 125 v.; Cat. Nos. 60460-63. Three-circuit, 2 a., 250 v.; 5 a., 125 v.; Cat. Nos. 60464-67. Manufactured by General Electrical Co., Schenectady, N. Y.

SWITCHES, SURFACE SNAP.

"Perkins" three-pole snap switches with Vulcabeston commutators, 15 amp., 125-250 volts. Cat. Nos. 2025, 2026, 2045, 2046. Approved Dec. 23, 1908. Manufactured by

Perkins Electric Switch Mfg. Co., Bridgeport, Conn.

TRANSFORMERS.

Bell Ringing Generator. A transformer with primary designed for connection to a 110 volt A. C. lighting circuit. Secondary coil with taps furnishing voltages of 6, 12 or 18 volts. Approved Jan. 18, 1909. Manufactured by

Connecticut Telephone & Electric Co., Meriden, Conn.

NEWS NOTES

FINANCIAL.

CHICO, CAL.—The report of the Chico Water Supply Company shows a profit of $2,000 last year on an investment of $155,456.

COLUSA, CAL.—The Colusa County Telephone Company has bought the system of the Pacific Telephone and Telegraph Company in Colusa county, the price paid being $15,000. The company now has entire control of the Colusa county lines and the long distance business will be handled over the Sunset lines, a royalty being paid for all long-distance switches. Work has commenced on the combining of the two lines and important improvements are being made.

EUREKA, Cal.—Superintendent M. M. Martin of the Humboldt Transit Company, has issued his semi-annual report of the receipts of the street railroad system for the six months ending last December. The total receipts for the last half year, are given as $42,660.50. The city's share, based on the ratio of 3½ per cent of the gross is $1,493. By months the receipts are given as follows: July, $7,909.90; August, $7,254.90; September, $7,369.30; October, $6,566.65; November, $6,385.25; December, $7,174.50. These figures show quite an increase over the receipts for the first six months of 1908, the receipts for that period being reported as $40,557.85, while a decided loss is shown as compared with the last six months of 1907, there being $45,152.85 taken in during those six months.

SANTA ROSA, CAL.—The Santa Rosa Water Company has issued a statement of receipts and expenses for the period since it began business. The revenues from all sources, for the year just closed, were $12,831.07, of which $12,262.52 was for water rents and $568.55 for service and connections. The net earnings for the year were $3,989.62, and the expenditures were divided as follows: Renewals, repairing and street work (including materials), $2,314.50; rents and miscellaneous office expenses, $905.74; sundries, $310.38. The gross receipts since the commencement of business to January 1, 1908, were $359,518.10. The construction account to January 1, 1908, totaled $186,602.75, and for the past year $210, which makes a grand total of $186,812.75.

OAKLAND, CAL.—President Louis Titus, of the People's Water Company announced in a statement last week that beginning with the new fiscal year the people of Oakland would be granted a reduction of five per cent in water rates. The lowering of the rates is part of an agreement of the water company to grant a yearly reduction until the rates reach the figures which prevailed during the Dornin Council, 29 per cent less than the rate of last year. Because the revenue derived from the city last year had fallen $30,000 short of the expected returns, the company could not see its way clear to grant a greater reduction. It is estimated that to reach the Dornin rate will require an annual five per cent reduction for five years. The net revenue for the Oakland division during the year was $529,000. On this figure the rate charged was 16 cents per 1,000 gallons.

SAN FRANCISCO, CAL.—Manager E. C. Bradley, of the Pacific Telephone and Telegraph Company, has stated before the Board of Supervisors that the valuation of the company's plant is $7,218,269.82. This valuation includes a $450,000 franchise. The net earnings were $547,182.03, or a trifle over 8 per cent on the valuation, excluding the franchise allowance. The company's business has increased at the rate of 1,000 new telephones a month, the total number of telephones now installed exceeding 47,000, but Mr. Bradley believes that when the Home Company begins service this rate of increase will be checked somewhat. Although the present rates are considerably lower than those which previously prevailed he states that the company will be satisfied with the continuance of the prevailing rates. It was also mentioned that about only half the public stations are profitable, the San Francisco office being credited with but 15 per cent of the long-distance business which emanates from this city. Mr. Bradley stated that similar conditions exist in Los Angeles and that during the past year the company had lost considerable money there.

INCORPORATIONS.

BAKERSFIELD, CAL.—The Coalinga-Kern Oil Company has been incorporated here with a capital stock of $100,000 by J. B. Wrenn, F. W. King and J. Robinson.

CENTRALIA, CAL.—The Twin City Light and Traction Company has been incorporated here with a capital stock of $400,000 by H. C. Coffman, T. Hoss and A. Welch.

FRESNO, CAL.—The Kerman Land and Water Company has been incorporated here with a capital of $25,000 by W. S. Brush, G. B. Raum, S. T. Hall, G. E. and M. E. Hart.

BAKERSFIELD, CAL.—The East Coalinga Oil Company has been incorporated here by P. Rightetti, C. F. Reynolds, J. M. Ryme, John McMullen and J. H. Bernard.

SANTA ANA, CAL.—The Orange County Gas Company has been incorporated here with a capital stock of $200,000 by D. L. Peters, M. L. Bellus, J. W. Kemp, E. B. Rhoades and J. S. Mitchell.

LOS ANGELES, CAL.—The White Star Oil Company has been incorporated here with a capital stock of $100,000 by R. Arenz, W. W. Martin, W. H. Fuller, T. E. Shreiber, G. N. Fuller and others.

RENO, NEVADA.—The Postal Telegraph Cable Company has been incorporated here with a capital stock of $25,000, for the purpose of operating a line of magnetic telegraph through Nevada and other states. The incorporators are: W. P. S. Hawk, O. W. Bowers, and W. S. McCormick, of Salt Lake City.

TRANSMISSION.

REDMOND, OREGON.—It is reported that J. G. McGuffie will install a power plant at Cline Falls.

SONORA, CAL.—The Tuolumne Water Power Company has been granted the privilege of erecting transmission lines and maintaining electric light and power lines upon certain highways, until January 1, 1911.

SAN DIEGO, CAL.—P. F. Schaniel and A. N. Jones were granted a franchise by the Board of Supervisors to use the tidewaters at the entrance to False Bay for the purpose of erecting a wave motor to generate electric power to supply the bay and surrounding settlements with electric lights and power.

OROVILLE, CAL.—Secretary H. P. Wilson, of the Great Western Power Company, announces that work will soon be commenced on the increasing of the present capacity of the electric plant at Big Bend, to 144,000 horse-power. Construction work will also begin this spring on the dam that will convert Big Meadows into a reservoir site of 20,000 acres, where water will be stored in the winter for use during the dry season. It is estimated that five million dollars will be spent on the new works. The company has been busy for the past week erecting temporary poles to take the place of the number of steel towers that were blown down by the recent storms.

NORTH YAKIMA, WASH.—R. B. Brown of Seattle, has appropriated 10,000 cubic feet per second of water from the Yakima river to be used for power purposes.

MEYERS FALLS, WASH.—The Northwestern Light and Power Company and the Spokane International railway expect to construct a power plant to cost $100,000.

PALOUSE, WASH.—The Idaho-Washington Light and Power Company of which M. J. Shields, of Moscow, is head, is said to have taken over the plant and business of the Palouse Light and Power Company.

PORTLAND, ORE.—An electric submarine cable carrying 10,000 volts is to be placed under the Columbia river to carry power for lighting and other purposes in Vancouver by the Portland Railway, Light and Power Company.

SANDPOINT, IDAHO.—The Pend d'Oreille Water and Light Company of this place have entered into a contract with the Humbird Lumber Company, through T. J. Humbird, the president, to furnish water and light for the new town of Kootenai, two miles north of Sandpoint.

PRESCOTT, ARIZ.—M. J. Hickey, Robert Brow and Henry T. Andrews have been granted a franchise by the City Council to erect and operate an electric lighting and power system. Steam, hot water and hot air heating, cold storage, telephone and telegraph systems will also be established.

BAKERSFIELD, CAL.—Contracts are being signed by West Side oil men for a year's supply of water at 4 cents a barrel with a new company promoted by R. E. McCauley, of Los Angeles. The company, which is said to be backed by English capital, proposes to build a pipe line from Ray's creek on Pine Mountain about forty miles south of Midway.

SALT LAKE CITY, UTAH.—The Utah Light and Railway Company is about to order a second 75-ton, 3,000 horsepower motor generator costing $35,000, the order being a duplicate of the machinery just installed by Minneapolis manufacturers. An emergency plant, costing half a million will be erected without delay at the Jordan River with a steam power equal to one-half the total demands made on the present plant.

TELEPHONE AND TELEGRAPH.

RAYMOND, WASH.—W. W. Cannon has been granted a telephone franchise. He will rebuild the local system.

MEDFORD, OREGON.—The Citizens' Telephone Company has asked for a franchise. Plans for a telephone building to cost $10,000 have been completed.

SONORA, CAL.—General Manager T. S. Thornton, of the Tuolumne Water Power Company has been awarded a franchise by the town trustees for a telephone line from the city limits through Barratta street, over Wolfling's property and across Leonard's hill.

SAN FRANCISCO, CAL.—The Oceanic Steamship Company has closed a contract with the United Wireless Telegraph Company for the installing of wireless plants on the steamers Mariposa and Alameda. The plants will be installed on the next arrival of the steamers in port.

MULLAN, IDAHO.—For the purpose of installing an up-to-date plant at Mullan and an exchange to take the place of the temporary exchange, and to extend the service of the company along various lines, it has been decided by the stockholders of the North Idaho Telephone Company to increase its capital stock from $25,000 to $100,000.

SAN RAFAEL, CAL.—Manager Fraquelin, of the Pacific Telephone and Telegraph Company states that $150,000 is to be spent in improving the local systems about San Rafael. Two-thirds of this amount is to be expended in improving the plants in Ross, San Anselmo and Kentfield. All the overhead wires are to be supplanted by a large cable. The monthly valley rate will be reduced at least 50 per cent.

ILLUMINATION.

NAPA, CAL.—H. D. N. Lehe has been granted a fifty year franchise by the supervisors of Napa county for a transmission system for transmitting electric light, heat and power.

LOS ANGELES, CAL.—The Anaheim Gas Company has practically completed arrangements for taking over the gas company of Orange. The works will probably be moved to Anaheim and the consumers of Orange will be served by pipe line from Anaheim.

LOS ANGELES, CAL.—J. R. Anderson & Company, of Pasadena, have been granted by the trustees a fifty year franchise for installing gas mains here. Work on laying pipe will begin about March 1st.

SAN FRANCISCO, CAL.—A warrant has been issued against the San Francisco Gas and Electric Company by the Fish Commission of this city charging the company with discharging refuse oil and coal tar products into the bay. Professor Frank T. Green, of the Affiliated Colleges, has been engaged to analyze the deposits and his reports are expected this week.

TRANSPORTATION.

LEWISTON, IDAHO.—M. A. Means has been granted a franchise for a street railway in Lewiston.

OLYMPIA, WASH.—C. T. Mork is endeavoring to get a franchise for an interurban line between Tacoma and Olympia.

LOS ANGELES, CAL.—W. F. Vollmer, has been awarded by the council a franchise for a street car line on Fifty-fourth street from Hoover street to Dalton avenue.

SNOHOMISH, WASH. — The Everett-Tacoma Railway Company has been formed with a capital stock of $2,500,000 to build an electric railway through Snohomish and Cherry valleys. G. M. Cochran of Snohomish is interested.

SAN FRANCISCO, CAL.—Chief Engineer B. P. Legare, of the United Railroads, in the absence of General Manager Black, asserted before the Board of Public Works this week that the company would expend $500,000 in track betterments during the spring, and during the next four years probably $5,000,000 would be spent. Just as soon as the weather settles work will begin on the completion of the Market street job. He promised that Twenty-ninth, Devisadero and McAllister streets would soon be given new road beds with heavy rails.

OIL.

LOS ANGELES, CAL.—The big well of the Pacific Petroleum Company at Beverly, owned by the West Coast Company, is drawing the attention of prominent oil men. The gusher is increasing its output and now, by calculations based upon measurements, it is producing an average of 1,200 barrels a day. There is not a piece of land to be had in the entire vicinity and property which a few weeks ago could be bought for $1,500, cannot now be bought for three times that sum. A rotary and bore is being erected on the southeast corner of the Consolidated Petroleum just north of this site, this being the first new work to get this vicinity under way.

REDONDO, CAL.—The Associated Oil Company, who established themesives here last spring, are making plans which will undoubtedly make Redondo one of the largest distributing ports on the Pacific Coast. Seventeen agents, representing the company, are in foreign countries and it is understood that a contract has just been closed with a Tokio concern whereby a line of Japanese oil vessels will ply between the Orient and this port. Negotiations are also being made with a South American concern for the shipment of oil. This company is now shipping over over 60,000 barrels a month from this port to San Francisco.